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ABSTRACT

This handbook is intended to facilitate the assessment of technology used to support elementary and secondary education in the United States. It is designed to help decision makers and technology users prepare, collect and assess information about whether and how technology is being used in their school systems. To make assessments that will be the basis for good decisions about the distribution and use of computers in the educational environment, well-focused data are necessary. The guide is organized around key questions pertaining to the type, availability, and use of technology in education systems. The key questions are grouped into seven primary topics, each with a chapter: technology planning and policies; finance; equipment and infrastructure; technology applications (software and systems); maintenance and support; professional development and training; and technology integration. For each topic, authors identified key questions and how they could best be answered. A measure, the result of which answers the key question, is called an indicator and more than one indicator can be provided for a given key question. After listing key questions for the topic and an overview, each chapter defines the topic precisely in order to delimit the area of assessment and then discusses the indicators that provide answers to key questions. A master list of key questions is provided at the beginning of the guide. Includes a glossary and two appendixes, "Data Elements and Term Definitions" and "Creating Indicators from Unit Records and Data Elements: Some Examples." (AEF)

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# Technology in Schools

## Suggestions, Tools and Guidelines for Assessing Technology in Elementary and Secondary Education

National Forum on Education Statistics

**U.S. Department of Education**
Office of Educational Research
and Improvement
NCES 2003-313

ED 474 409

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# Technology in Schools

## Suggestions, Tools, and Guidelines for Assessing Technology in Elementary and Secondary Education

November 2002

**U.S. Department of Education**
Office of Educational Research
and Improvement
NCES 2003-313

Technology in Schools
Task Force

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# Master List of Key Questions

**Chapter 1: Technology Planning and Policies**

*TP1. Are there technology policies?*
*TP2. Is there a technology plan?*
*TP3. Is the plan being implemented?*
*TP4. Is the plan being evaluated?*

**Chapter 2: Finance**

*FI1. How does your school district compare in technology expenditures with others in your state?*
*FI2. How much was spent in the past academic year for instructional and administrative equipment purchases?*
*FI3. How much was spent for instructional and administrative applications and software?*
*FI4. How much was spent for maintenance and support?*
*FI5. How much was spent for instructional and administrative professional development?*
*FI6. How much was spent for connectivity and infrastructure?*

**Chapter 3: Equipment and Infrastructure**

*EI1. Is equipment present in instructional settings?*
*EI2. Is equipment available for use by students?*
*EI3. Is equipment available for use by teachers?*
*EI4. Is equipment available for use by administrators and support staff?*
*EI5. Does the infrastructure have the capacity to support the school's technology needs?*

**Chapter 4: Technology Applications**

*TA1. Do the school or district's instructional applications support teaching and learning standards across the curriculum?*
*TA2. Is there software support for technology tool skill development?*
*TA3. Does the school/district use technology applications to improve communication?*
*TA4. Does the school/district have appropriate software and systems to support primary administrative functions?*
*TA5. Are the applications in use evaluated for effectiveness?*

**Chapter 5: Maintenance and Support**

*MS1. Are resources and processes in place to maintain school technology?*
*MS2. Are personnel available to provide technical support?*

**Chapter 6: Professional Development**

*PD1. What technology-related training and/or professional development do staff receive?*
*PD2. What are the goals, methods, incentives, and content of technology-related training and/or professional development for staff?*
*PD3. How are training and/or professional development for staff evaluated?*

**Chapter 7: Technology Integration**

*TI1. Are teachers proficient in the use of technology in the teaching/learning environment?*
*TI2. Are students proficient in the use of technology in the teaching/learning environment?*
*TI3. Are administrators and support staff proficient in the use of technology in support of school management?*
*TI4. Is technology integrated into the teaching/learning environment?*
*TI5. Are technology proficiencies and measures incorporated into teaching and learning standards?*
*TI6. Are technology proficiencies and measures incorporated into student assessment?*
*TI7. Is technology incorporated into administrative processes?*
*TI8. Is technology proficiency integrated into the evaluation of instructional and administrative staff?*

# Acknowledgments

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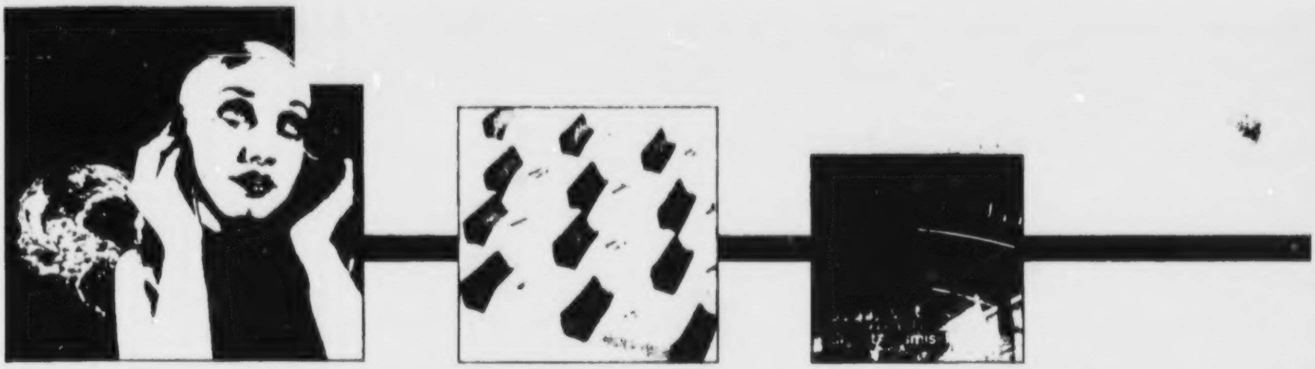

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# Foreword

This guide began with discussions within the National Forum on Education Statistics (the Forum) about the number and diversity of technology-related surveys that schools, school districts, and state departments of education are asked to complete. Consensus developed that agreement on the important questions, and an understanding of how answers to these questions might be assessed, would serve an important public policy purpose. A Forum Technology in Schools Task Force was created and began its work in January 1999.

This document is the result of the task force's work over more than 3 years and represents a joint effort of state and local education agency representatives who are involved with issues related to technology in schools.

The Forum is a representative body sponsored by the National Center for Education Statistics (NCES) of the U.S. Department of Education in collaboration with the states. The purpose of the Forum is to help improve the quality, comparability, and timeliness of data used for education policy at all levels of government. The mission of the Forum is to develop and recommend strategies for building an education data system that will support local, state, and national efforts to improve public and private education throughout the United States.

The results of the task force's labors provide a resource for educators and policy makers who are responsible for assessing the need for, and the effects of, technology in schools. The strategy chosen by the authors has been to identify key questions on the use of technology in educational management and instruction, and to specify how such questions might be answered. Throughout, the task force's intent has been to suggest, not prescribe. This guide provides a wide range of options and suggestions for technology administrators to adapt assessment to their school's situation and needs. The indicators and data elements listed in the handbook are a larger collection than any school district may want to establish.

## Feedback and More Information

Please note that this guide is also available on the Forum's web site. Since technology and schools evolve, this document will require continual revision. We urge readers and users to provide comments, examples of data collection efforts, and materials. Feedback can be provided to the Technology, Dissemination and Communication (TD&C) Committee of the National Forum on Education Statistics, through the web site at ***http://nces.ed.gov/forum***, where information about the Forum, its membership, meetings, and working groups can be also be found.

A number of references in the Handbook refer to web sites on the Internet. These references were current at the time of publication; however, the authors cannot guarantee that they will continue to work into the future. The online version of the Handbook will have its references periodically updated and web sites checked. Readers finding expired web site references are asked to look elsewhere on the same web site, to communicate with web site owners, and to communicate with the handbook authors through the Forum web site at **http://nces.ed.gov/forum** .

Users may also be interested in related Forum products, available on the web site above, such as:

*Standards for Education Data Collection and Reporting (SEDCAR)*
(see **http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=92022**)

*Technology@Your Fingertips*
(see **http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98293**)

*Student Data Handbook for Elementary, Secondary, and Early Childhood Education: 2001 Update*
(see **http://nces.ed.gov/pubsearch/pubsinfor.asp?pubid=2000343R**)

# Executive Summary

This handbook is intended to facilitate the assessment of technology used to support elementary and secondary education in the United States. It is designed to help decision makers and technology users prepare, collect and assess information about whether and how technology is being used in their school systems. To make assessments that will be the basis for good decisions about the distribution and use of computers in the educational environment, well-focused data are necessary.

Since computer-based communications technologies are continually evolving, and since their distribution throughout the education system is continually changing, responding to the demand for technology data requires ongoing information gathering. Deciding what levels and types of technology are required and/or deployed to accomplish instructional or management goals requires information and insight into the roles that technology plays in the education system.

Since education groups of all kinds—from policymakers at various levels, to commercial interests, to professional associations, to education managers and planners—repeatedly ask nearly the same questions, coming to agreement on standard questions and answers can help reduce redundancy and improve comparability in the questions asked and the answers provided. More timely and accurate data collection might in turn lead to reduced frequency of collection; it should certainly lead to more consistent reporting.

Ad hoc technology surveys are expensive and time-consuming for all participants and rarely produce information that can be compared across states or districts or over time. Much of the information needed about the status and use of technology resources in schools can be provided by existing information systems or obtained from available records that schools or school districts may keep about their computer and software purchases, use, and maintenance. But some information may be more appropriately gathered by way of specially designed and administered surveys using questionnaires focused on those specific issues. Building the capacity to answer key policy questions into management systems, whether for property, staff, or instructional support, can lead to better data with less effort.

Because the role and impact of technology in the education system are extremely pervasive and the need to know correspondingly broad, this guide deals with the integration of a wide range of electronic technologies into support of school management and instruction. Topics include not only the availability of equipment and software, but also function: the ways of using computers and networks, and other equipment, to support all aspects of the school enterprise.

Key audiences for this handbook are those people who collect, store, publish, or use information about technology in its applications in schools and districts. These include educators and educational administrators—teachers, principals, and technology coordinators—as well as hardware and software vendors and information collectors and users. Other important audiences are program managers and planners at federal, state, and district levels.

The guide is organized around key questions that the Technology in Schools Task Force authors have determined to be central, pertaining to the type, availability, and use of technology in education systems. The task force was composed of state education agency managers and school district technology coordinators, practitioners, and leaders; they discussed among themselves and polled their colleagues to identify the most commonly asked, and most important, questions about technology in schools.

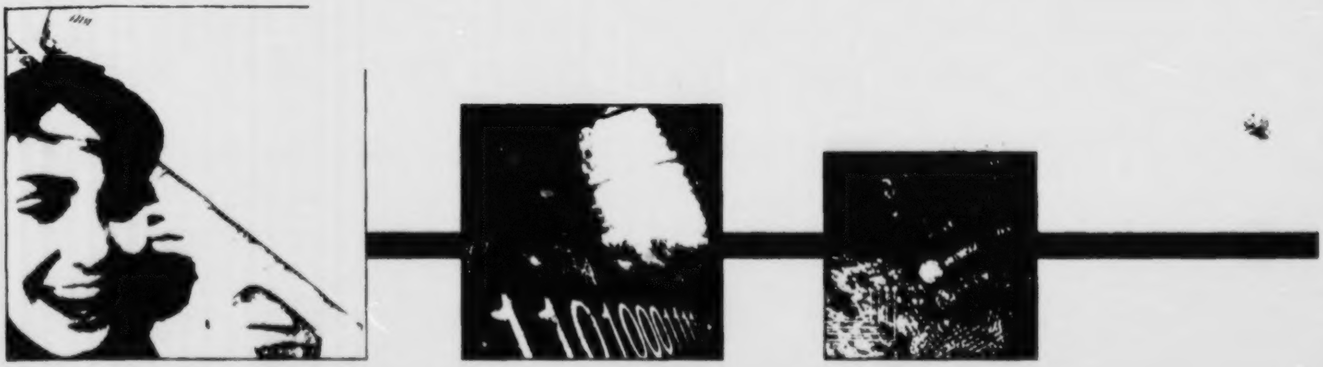
The key questions are grouped into seven primary topics, each with a chapter:

- technology planning and policies;
- finance;
- equipment and infrastructure;
- technology applications (software and systems);
- maintenance and support;
- professional development and training; and
- technology integration.

For each topic, authors identified key questions and how they could best be answered. A measure, the result of which answers the key question, is called an indicator and more than one indicator can be provided for a given key question. Much of the panel's discussions dealt with what indicators were the proper measures for key questions—ones that were both measurable and meaningful as responses to the key questions, and that ideally would retain their meaning across time and technological evolution. Indicators are based on single items of information called data elements. Data elements may be combined in various ways to produce indicators.

After listing key questions for the topic and an overview, each chapter defines the topic precisely in order to delimit the area of assessment and then discusses the indicators that provide answers to key questions. Technology administrators will have a range of suggestions and options to adapt to their own assessment needs. Indeed, making it possible to adapt suggestions for assessment to a school district's requirements is a major purpose of this guide.

The indicators and data elements that comprise answers to key questions include a range of information that may extend beyond the requirements of a given school or school district. The document is deliberately broad in scope in order to meet a diverse range of needs. On the other hand, the information included may not reflect all the needs of some school settings. It should be possible, however, to gain sufficient insight from the items provided to construct what is required to evaluate the status of technology in a given school environment.



# Introduction

In recent years, schools have invested heavily in putting technology—especially computers and their associated infrastructure—in the hands of students, teachers, and administrators. Many people involved in education, from legislators to teachers to parents, as well as the general public, want to know what technology exists in schools and how that technology is being used. These are a few of the questions that are typically asked:

- How can technology support the educational vision for our district?
- What are our technology needs?
- Are our technology goals right for our needs?
- Have we reached our technology goals yet?
- Where has the money gone?
- Are we doing as well as others?

**The story of Jane Neussup, the newly appointed superintendent of Freshlook County Schools...**

(Note: There is one part of the story for each chapter of the handbook.)

***Introduction***

Jane is settling into her new job and is holding a meeting with key staff members to learn more about the programs at Freshlook County Schools. Today she is meeting with John Techno, the district's technology coordinator.

The first two questions she asks him are "What did we spend last year on technology in the district?" and "I started out as a science teacher; how is technology being used in science instruction?"

John answers, "I can get you the expenditure numbers from our technology plan. And as for science instruction, each high school has wiring drops in every science lab and three Pentiums® running Windows 98 in each lab."

Jane says, "I appreciate the information, John, but what does that tell me about how students are using technology to learn science?"

John replies, "Well, Dr. Neussup, I don't know, but I'll find out."

[To be continued...]

# Purpose of This Guide

This guide has been developed to help answer those questions listed on the previous page and many others related to them. It is meant to fulfill several purposes:

- to provide guidelines and tools to gather information on the presence and use of technology in schools;
- to facilitate the development and maintenance of data on technology in schools;
- to help reduce the redundancy and diversity in data collection and, simultaneously, to facilitate comparability in the information obtained; and
- to increase awareness of the breadth of issues related to the deployment of technology in educational settings.

As it fulfills these purposes, the guide should help focus questions asked about computer technology in education so that more meaningful policy and discussion can emerge.

# For Whom Is This Guide Intended?

This document was prepared for the people who must request, collect, assemble, or assess information on technology in schools. The main intended audiences include:

- **Technology coordinators** for schools or districts who need to store information in a database for later retrieval, so they can answer questions in technology surveys, inventories, etc.
- **Principals and school administrators** who want to ensure that technology is being used effectively in their school or district. In addition, special program coordinators (e.g., for Title I, special education) may want to know how technology can support their program goals.
- **National, state, and local decision makers** who are responsible for planning for technology in schools, allocating resources to the schools, and assessing the effects of technology in them.
- **Legislators and other policymakers** (or their staff) who want to know how funds appropriated for school technology are being used.

Others within the educational environment who may directly benefit from this handbook include teachers who are looking for information on technology proficiency standards, survey developers who want to compare ideas for their own questions, and software vendors who create information management systems for schools.

Since education groups of all kinds—from policy makers at various levels, to commercial interests, to professional associations, to education managers and planners—repeatedly ask nearly the same questions, agreement on standard questions and answers can help reduce redundancy and improve comparability in the questions asked and the answers provided. More timely and accurate data collection might in turn lead to reduced frequency of collection and more consistent reporting.

## Defining Technology in Schools

The term **technology in schools** can have many different meanings in different contexts and times. As used in this guide, technology pertains to the full range of computer and computer-related equipment and associated operating systems, networking, and tool software that provide the infrastructure over which instructional and school management applications of various kinds operate. And, in order to assess the effects of technology, this document goes beyond equipment and infrastructure. It includes how, how well, and by whom technology is used, as well as the resources that are required for user support. Such aspects as libraries and information services; security needs, both for the protection of facilities and equipment and for the assurance of the safety of both students and staff; the integration of technology into such areas as facility design and professional development and training—technology extends to all these parts of the educational enterprise.

For the purposes of this handbook, equipment includes both hardware and software, such as:

- computers and computer-driven equipment, as well as the peripherals that are attached to computers (such as printers, scanners, digital cameras, projectors, etc.);
- servers, routers, switches, transceivers, and other equipment that support wired and wireless communication between computers, providing access to other computers, local- and wide-area networks, and the global Internet;
- support for state-of-the-art telephone-based technology, including voicemail and fax technologies, that can improve instructional and administrative capabilities and support parent-school communication;

- audio and video equipment (including satellite receivers and transmitters, cable boxes, and other items) used in distance education;
- display equipment used in classrooms, including television monitors, opaque and transparent projectors, and electronic whiteboards; specialized calculators and computers, including personal digital assistants, graphing calculators, and measuring/data collection tools for such purposes as chemical or biological assay or weather measurements;
- the infrastructure of wires and cables (and, more and more, the wireless systems) that support computer-based networking and video access. Although this infrastructure is formally part of school facilities, some elements are defined in this handbook since their specification matters to the operation of technology in schools; and
- the software applications and programs that are pertinent to the education system. These include programs that are used to support instruction or control management processes.

It is also important to consider the institutional knowledge base of schools and districts as a factor in technology in schools; it serves as a foundation for an effective system and can be observed in patterns of institutional behaviors that provide continuity to the educational system.

## Organizing Principles of This Guide

### Key Questions ➔Indicators ➔Data Elements➔Unit Records

### *Key Questions*

This guide is organized around key questions that are asked about the distribution and implementation of technology in the educational environment. They reflect the primary concerns about technology of decision makers and stakeholders in the educational enterprise. They may be asked by anyone inside or outside the educational environment, but are usually asked by decision makers who have an impact on the distribution of resources. Key questions often pertain to the type, availability, distribution, and use of computer technology and peripherals, as well as related software and numerous other related factors.

Key questions often turn out to be complex and multifaceted when scrutinized with a view to gathering information that would provide a useful response. Take a simple-sounding key question, such as "How many computers are there in this school district?" On the surface, it would seem that the person asking the question knows what information is available and what is to be done with the answer. However, the person doing the work of getting the information finds all sorts of dilemmas. First, what is really meant by computer? Does an old computer stored in a closet still count? What if a computer doesn't work any longer?

A second dilemma is where to get the information. Are there records about computers that were purchased or does someone have to count how many computers there are? In this fashion, apparently simple key questions may require considerable elaboration in order to clarify what information is to be collected and make sure that it is measurable.

### *Indicators*

In any case, the person asked to gather this information needs to develop some measures that will help arrive at a satisfactory response. Those measures that provide answers to the question are called indicators.

### *Data Elements*

A data element is a single item of information or measurement in a database (or other collection of information) that is the basis of an indicator. For the sake of brevity and narrative clarity, the data elements for all chapters are indexed by key question and indicator in Appendix A. Appendix B then offers examples of rules used to combine data elements into indicators.

Some indicators are simply based on a single data element, while others may require more complex combinations of data elements. For example, the number of computers is a simple indicator. A more complex indicator would be the percentage or ratio of the number of "functioning" computers to the number of students. In some cases, more than one indicator may be required to provide a meaningful response to a key question.

### *Unit Records*

A collection of data elements for a single unit (which could be a single computer, a single technology user—teacher, student, or administrator—or a single classroom) is called a unit record. The individual item about which a series of data elements is collected is a unit. In effect, information (data element[s]) is collected about a computer (unit on which a record is kept), and, hence, a unit record is created. For example, the year a computer was purchased is a data element. The information about its repair condition or its location are also data elements. The computer is the unit. The string of information about that computer becomes the unit record.

**"Getting It All Together"**

Information pertinent to key questions may be obtained from a variety of sources:

- Administrative records associated with the purchase and maintenance of technology may already hold much information.
- Standards created by a range of local, state, and national organizations can be converted to ratings systems. Ratings produced by applying such systems assess the status of standards-based indicators. Technology coordinators, administrators, or teachers may be asked to provide such ratings, ideally after training to improve consistency and understanding.
- External evaluators address issues of objectivity of training and measurement consistency. Ad hoc surveys, self-ratings, and observation may also be tools to use depending on needs, the data collector, and school setting.

## Using the Guide

Readers, according to their goals, can use the key questions and indicators by topic to develop information to support decision making. They can:

- use key questions to delimit the scope of an assessment;
- use indicators to describe areas to be assessed;
- use indicators as "authoritative support" for key questions, especially if standards-based indicators are used for measures (for example, in Chapter 7, Technology Integration);
- use other indicators as items for surveys in and of themselves, or base surveys on measures listed; and
- construct databases from data elements in this handbook, in order to establish a "data warehouse" on the status of technology in schools and districts.

Users can begin by reviewing the complete list of key questions on page iii of the handbook and then refer directly to the chapter that covers a key question of interest. They can then consider one or more of the indicators that help to answer that question. Or, they can go directly to a topic of interest, such as finance, and study key questions and indicators dealing with that topic only.

## What Topics This Guide Covers

Each of the substantive chapters begins with a list of key questions, followed by a narrative overview and definition of the chapter topic. Each key question is then discussed in turn, listing one or more indicators. Terms are described when they are first used. Where relevant, an example unit record is provided. Each chapter ends with a list of resources and references.

The material and key questions on technology related to education are grouped into seven chapters, based on the best judgment of experts in technology in education upon review of available materials.

- Chapter 1—Technology Planning and Policies—addresses the documented strategies that provide direction for the acquisition, use, maintenance, and expansion of technology in the educational enterprise. Three major areas are addressed: vision, access, and integration.
- Chapter 2—Finance—covers issues related to expenditure categories for technology.

- Chapter 3—Equipment and Infrastructure—describes the availability of computers and other equipment in use in administrative and instructional settings, as well as the connection of computers and other equipment to local and wide-area networks and to the Internet.
- Chapter 4—Technology Applications—pertains to the administrative (e.g., school management and record keeping) and instructional uses (e.g., instructional software or distance learning) to which computer technology is put.
- Chapter 5—Maintenance and Support—focuses on the processes employed to maintain computer hardware and software (what organizations do to maintain technology systems) and what personnel are allocated and under what circumstances personnel are allocated for technology maintenance.
- Chapter 6—Professional Development—pertains to professional development and training related to technology (i.e., tracking professional development opportunities being offered, who has taken courses, training and professional development needs, and potential effects of such training).
- Chapter 7—Technology Integration—pertains to how and to what extent technology is a tool for administrative productivity, decision making, and instructional practice. Indicators in this chapter address student and staff proficiency in the use of technology, the integration of technology into the curriculum and teaching practice, and the use of computers and network systems in school management.

**"The Changing Nature of Information"**

Users should bear in mind that while the information included in this handbook is based on the best and most current assessment by experts, technology is extremely dynamic and subject to continuous and rapid change. **Adapting the handbook's information to new technology and applications is part and parcel of using this guide.** Users with ideas for changes should also see the note on "Feedback and More Information" at the end of the Foreword.

## What the Handbook Does and Does Not Do

This handbook condenses a great deal of information: nearly three dozen key questions and several hundred indicators and data elements. The intent has been to provide a comprehensive list of indicators and data elements from which users may choose standard terms and measures for their own purposes. Creating a database or a computer system to represent all this information would be a substantial burden for technology coordinators who spend most of their time supporting users. The handbook authors offer suggestions and alternatives for indicators that answer key questions; they do not prescribe that all of this information be collected. Rather, it is expected that users will choose indicators and data elements that address issues of particular interest and importance to their schools and districts.

The guide's indicators of technology availability and use can be paired with locally determined measures of student achievement, operational efficiency, or other outcomes, so as to assess the relation between technology inputs and desired results.[*] This handbook does not directly address student or management outcomes, beyond evidence of deployment and utilization of technology in the K–12 setting. Outcome measurements (not themselves technology indicators) are beyond the scope of this document.

This handbook also does not directly address measurement issues, such as the reliability and validity of the data elements listed. Measurements are, to varying degrees, reproducible over time and across inquirers and forms of inquiry; and they are, to varying degrees, also accurate reflections of the concepts they purport to measure (as determined by a consensus of stakeholders, or other means). These issues matter, and much is written about them, but their proper consideration exceeds both the space available and the competence of our panel.

The purpose of this document is to allow decision makers to make choices about the various kinds of information they need, to select some questions that are truly "key," and to focus and organize data collection and information management to produce useful information, so as to make better decisions.

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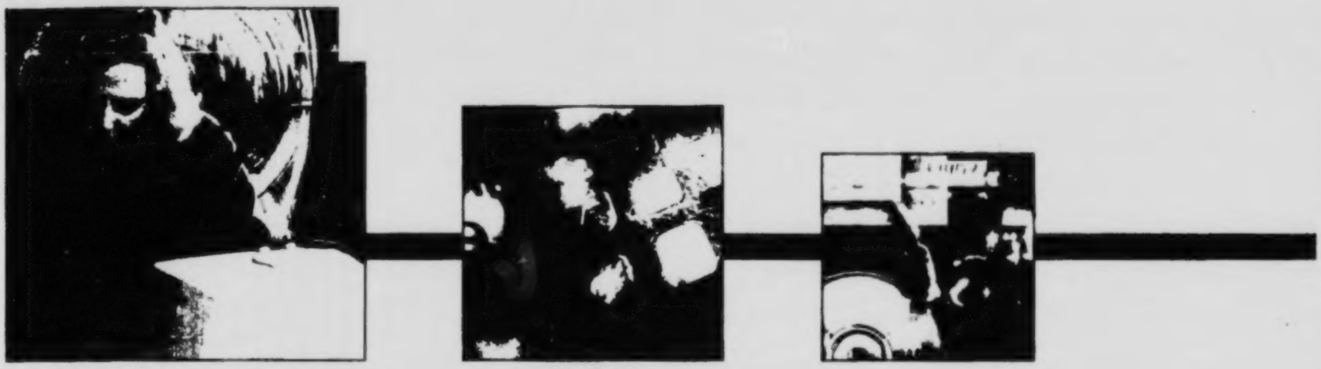
[*] For a recent summary of issues and findings in evaluating technology's impact on student outcomes, see *The 1999 Secretary's Conference on Educational Technology: Evaluating the Effectiveness of Technology* [**http://www.ed.gov/Technology/TechConf/1999/whitepapers.html**]; in particular, there are a number of white papers on assessing technology in relation to student outcomes. Unfortunately, there is much less published on the impact of technology on school management and function.



*"Build a technology plan around teachers' needs, and they will come."*

**Ken Eastwood,** assistant superintendent for curriculum, instruction, and technology, Oswego City School District, New York, and *Computerworld* Smithsonian laureate

# Chapter 1

## Technology Planning and Policies

### What to Expect From This Chapter

- Suggestions for what the phases of a technology plan may involve
- Resources and ideas for evaluating technology plan implementation
- Resources and ideas to make technology plans comprehensive
- Suggestions for policy development processes

**The story of Jane Neussup continues...**

***Planning and Policies***

John Techno has been asked by the superintendent, Dr. Neussup, to report on last school year's expenditures for technology. The next day he shows up in her office with the most recent report on the implementation of the Freshlook County technology plan, and shows her where the financial summary tables are to be found.

Dr. Neussup thanks him, and reminds him she had also wanted him to find out how students are using technology to learn science. While he's scratching his head over this request, Dr. Neussup adds "While you're at it, what does our technology plan say about integrating technology for all of the content areas?"

John replies, "I am on the technology planning committee. One of the goals of the plan was to *Integrate Technology Into the Core Curriculum*. At the time, I wasn't sure what that meant, but after talking with you I'm beginning to have a better understanding of why that's included in the plan. I was planning to check with the science teachers; let me also do some research in the other content areas to find out how close we are to achieving this goal."

[To be continued...]

# Key Questions for This Chapter

1. Are there technology policies?
2. Is there a technology plan?
3. Is the plan being implemented?
4. Is the plan being evaluated?

# Overview

This chapter addresses the assessment of documented strategies that direct the acquisition, use, maintenance, and expansion of technology in the educational enterprise. These strategies are expressed in policies or as a school or district's technology plan. The overall goal of technology policies and plans is the successful integration of technology to support student learning and school management.

In content terms, technology planning and policies should address three major areas: vision, access, and integration. Vision pertains to what is expected from the technology overall. Access refers to the acquisition, deployment, and availability of technology to the target audiences. Integration of technology is the development and implementation of strategies that make technology useful and capable of accomplishing the vision. More detailed content lists are given in what follows.

In terms of process, policies represent relative end states that begin with the adoption of a technology plan. This in turn involves a series of steps, ranging from the determination of needs, the involvement of stakeholders, and the ratification of a document, to the implementation, evaluation, and revision of the plan.

Assessing plans and policies involves evaluating the content of plans and documenting the existence of policies, as well as assessing the process of plan development and implementation.

The key questions in this section, and the indicators that point to their answers, will be useful to the persons who most likely already know (or can easily find out) their answers: the school or district technology coordinator, or (in larger districts) the Chief Information Officer (CIO) or administrator functioning in the CIO role. They will also provide reporting information to these persons' superiors: superintendents and school board members. That the person closest to the information might find it useful to respond to these questions might seem paradoxical, but the purpose of responding to these questions is precisely to record the state of technology planning and implementation for the local education agency (LEA). Thus, answering these questions provides a snapshot in time, a point of reference and reporting from which comparisons can be made.

## Defining Technology Plans and Policies

Policies are guidelines for activity, put into writing and officially decreed or accepted by the organization. In a sense, technology plans represent end points for which technology policies are a beginning and a road map.

There is perhaps no better definition of a technology plan than that described by the Regional Technology Education Consortia's (RTEC) Technology Plan Task Force: "A technology plan serves as a bridge between traditional established standards and classroom practice. It articulates, organizes, and integrates the content and processes of education in a particular discipline with appropriate technologies. It facilitates multiple levels of policy and curriculum decision-making, especially in school districts, schools, and educational organizations that allow for supportive resource allocations." (See Resources for reference.)

As RTEC also points out, planning in general is a continuous, organizational process that provides "a road map." A plan for technology can maximize the potential of technological innovations while helping to overcome the challenges of implementation. Ultimately, it should result in more efficient expenditures and improved student achievement.

Questions about planning and policies interact with the content of all of the other chapters in this handbook. For example, security policies lead to firewall applications choices, covered in Chapter 4, Technology Applications; hardware aging leads to replacement policies, covered in Chapter 5, Maintenance and Support, as well as in Chapter 3, Equipment and Infrastructure. Issues of financial resources for technology are covered in Chapter 2, Finance, and so forth.

## Key Questions and Indicators

The initial key question refers to the environment that allows for a technology plan to be developed in the first place. It points to the broad policy-making efforts of a school or district, which will ultimately affect a technology plan's implementation. The remaining three questions refer to the plan itself and are very straightforward: is there a plan, what does it consist of, and how well is it being followed?

Perhaps the most critical component of planning is evaluation of the plan, addressed in Key Question 4; only through assessment is it possible to ascertain

**"Usage Tip"**

If you are in the process of composing a technology plan or assessing an existing plan, you can compare it to the sample major components of a technology plan listed in Key Question 2, Is there a technology plan? See "Term categories" for Key Question 2 for this chapter.

whether or not the plan is accomplishing the job its originators set out to do. Assessments may also be helpful in giving insight into what is most important in a technology plan, and it may therefore be useful to refer to this key question in composing a plan in the first place. Ultimately, evaluation will point to plan revisions and reveal the need for adaptability through periodic review cycles.

## *Key Question 1. Are there technology policies?*

Existing, implemented technology policies can be a background against which a technology plan is carried out, or they can be one desired end goal of the implementation of a technology plan. Examples of such policies might be acceptable use policies (AUPs) or policies related to the privacy of student data records. A school or district may also have broader policies in place that will influence a technology plan, such as business policies that could include requirements for impact analyses, financial contingencies, or security safeguards.

Policies with local impact can be adopted at any level, from the school to the district or region, or to the state as a whole. An example of district-level policy can be found at the Bellingham (WA) web site, ***http://www.bham.wednet.edu/policies.htm***. A framework for state technology policies developed by Chris Dede can be found at ***http://www.neirtec.org/statepolicy/forum1/default.asp***.

INDICATORS

| | |
|---|---|
| Policies are in place that will affect technology planning or implementation | Existence of policies. |
| | Types of policies currently in force. |
| Technology policies are in process | Existence of a policy development process. |
| | Types of policies currently in process. |

TERM CATEGORIES

**Types of technology-related policies:** acceptable-use (or appropriate-use) policies (AUPs); restrictions on access to student records; technology security policies; policies regarding acceptance of commercial advertising on school web sites; policies regarding acquisition, maintenance or disposal of school equipment or applications; policies regarding acceptance of donated equipment and software; policies regarding community or after-school access to school or district technology resources.

## *Key Question 2. Is there a technology plan?*

As stated in the Overview to this chapter, technology plans are central to technology deployment. They can be tools of reform and guidance, and as such they can impact every aspect of technology infusion in the school or district from dialogue to professional development.

Technology plans undergo review and approval by many outside groups. Some are reviewed and approved at the state or even federal levels. The requirement for outside review imposes structure on a plan. Plans not requiring outside review can be much simpler and can depend on the initiative of local proponents, such as a superintendent, principal, or teacher technophile. However, all planning efforts can benefit from considering the components listed in this chapter. All technology plans should take into account long-range funding issues; focus on instructional and administrative enhancements and goals; identify an implementation phase; coordinate all aspects of technology integration, including professional development or staff training; and evaluate outcomes.

The first indicator deals with the pre-planning phase, which must be given careful thought in order to ensure the success of a technology plan. The stages of a pre-planning phase include a current-status assessment of technology, including equipment, skills, and use. Additionally, a current and future needs assessment provides the plan with direction and credibility. Finally, the make-up of the planning team needs to be determined, and participants identified and recruited. The members of the planning team are the ones who will bring the plan to life, including solidifying district and community "buy-in" of the plan and finding the funds to make it happen.

INDICATORS

| | |
|---|---|
| Pre-planning phase completed or under way | Stages of the pre-planning phase completed. |
| Major plan components | The major planning components are present. |
| | Components of the plan. |
| Plan approval | The technology plan is approved. |
| Funding support | Percentage of total technology plan budget that has funds committed to its support. |
| | Percentage of the plan federally funded. |
| | Percentage of the plan state funded. |
| | Percentage of the plan funded through other (local or private) sources. |

TERM CATEGORIES

**Major plan components** can include:

- review of technology status, needs assessment, and other pre-planning products
- vision/goal statements
- equity issues
- instructional uses of technology

- student technology standards
- staff technology standards
- integration into core curriculum
- pilot program and action research
- management uses of technology
- student information systems
- infrastructure and support for infrastructure, including such facilities-related needs as air conditioning/cooling and asbestos abatement
- review of current "state of the art" for options in design of infrastructure
- capabilities of hardware and software, projections of "next generation" capabilities and features
- acceptance and management of donated computing resources
- long-range goals
- inventory control issues, such as maintenance and replacement cycle
- budget projections and funding sources for initial installation, hardware, and software
- staff training programs
- benchmarking standards
- quality control components
- security planning

There are potential components of a technology plan that can overlap with a school or district's facilities plan, such as network installation costs, including electrical wiring, maintenance and expansion. Technology planners and administrators will most likely want to decide in the pre-planning phase where to deal with facilities issues and related budgeting.

## *Key Question 3. Is the plan being implemented?*

Creating a technology plan and getting it approved and funded are only the beginning. Implementation has its own timeline and benchmarks, including purchasing equipment and installing, training, and evaluating each new technology introduced. The technology plan should account for each of these components, as well as implementers or teams responsible. The indicators below point to broad categories of implementation components. Technology planners will want to adapt their implementation efforts to the details of the overall plan and/or revisions to the plan.

INDICATORS

| | |
|---|---|
| Evidence of plan implementation | Status of each major plan component. |
| | Plan schedule and benchmarks are being met. |

## *Key Question 4. Is the plan being evaluated?*

Perhaps the most important aspect of the technology plan process is evaluating its results and impact. Provisions for revising the plan should be a part of its creation, in the form of a review cycle that includes timelines and reporting. Pos-

### "Evaluating the Implementation of Your Technology Plan"

Technology implementation is a continuous process that adapts to the organization's changing circumstances and includes ongoing evaluation. Effective evaluation will force planners to rethink and adapt objectives, priorities, and strategies as implementation proceeds. Continuous evaluation also facilitates making changes if aspects of the plan are not working.

Evaluating the implementation of a technology plan can be conducted by various means. Simple observations, both negative and positive, that have been made by students and teachers using the technology are the most helpful. Interviews and informal meetings with both instructors and students can draw out the lessons that both groups have learned from using the technology. A simple written survey can assist in measuring the extent to which the plan has met its original objectives and expected outcomes. The following questions may be addressed annually when planning the evaluation of the implementation of your technology plan:

- How and when will you evaluate the impact your technology plan implementation has on student performance?

sible components of the review cycle are listed below. If records from the pre-planning phase have been kept, the evaluation phase will be able to provide greater insight into the plan's progress and impacts. Possible means to obtain measures used to determine progress include customer feedback, plan audits, focus groups, and surveys.

It is important to remember that technology or parts of the plan that are not implemented should not be considered failures. Implementing new technology can be a daunting undertaking and flexibility is needed for any change process. For this reason, evaluation in a variety of formats is critical in objectively determining what is working and what needs more attention.

INDICATORS

| | |
|---|---|
| Evidence of evaluation | A review cycle (including timelines and reporting) is implemented. |
| | There is a provision for revision of the plan. |
| | The review is detailed in a report. |
| | The report is readily available to the school and community. |
| | The technology plan has been changed on the basis of the most recent evaluation review. |
| | Components of the review cycle. |
| | The plan is achieving its goals. |

TERM DEFINITIONS AND CATEGORIES

**Review cycle components** include accountability measures, such as identification of indicators during pre-planning to maintain records of progress; technical performance; student performance; community support; implementation benchmarks; budget analyses; utilization records; evaluation components; and progress measures.

## Unit Record Structure

Many of the indicators presented in this chapter can only be measured through specific data collection efforts, with surveys conducted or questions asked by the local technology coordinator or the CIO or acting administrator. The unit record structure presented in other chapters, in which administrative data routinely collected for a variety of purposes can be converted into indicators that provide responses to key questions on the presence of technology, is not really appropriate for data on the status of technology planning.

- Who will be responsible for collecting ongoing data to assess the effectiveness of the plan and its implementation?
- What windows of opportunity exist for reviewing the technology plan? (For example, the plan might be reviewed during curriculum review cycles.)
- How will accountability for implementation be assessed?
- How will you assess the level of technological proficiency gained by students, teachers, and staff?
- How will you use technology to evaluate teaching and learning?
- What is the key indicator of success for each component of the plan?
- How will you analyze the effectiveness of disbursement decisions in light of implementation priorities?
- How will you analyze implementation decisions to accommodate for changes as a result of new information and technologies?
- What organizational mechanism will you create that allows changes in the implementation of the technology plan and in the plan itself?

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# Resources

Eastwood, K., Harmony, D., and Chamberlain, C. (1998). "Integrating Technology into Instruction, How We Became One of the Best by Simply Listening." *Curriculum Technology Quarterly*, Association for Supervision and Curriculum Development.
Search archives at ***http://www.ascd.org/readingroom/ctq/framemain.html***

"Evaluating the Implementation of Your Technology Plan," North Central Regional Technology in Education Consortium.
See ***http://www.ncrtec.org/capacity/guidewww/eval.htm***

Levinson, E., and Surratt, J. (1999). "Five Components of an Effective Technology Plan," abstracted from "Taking Control of Technology Planning." *eSchool News*.
See ***http://www.eschoolnews.org/news/showStory.cfm?ArticleID=1349***

## *Planning tools*

Guiding Questions for Technology Planning, Version 1.0, Regional Technology Education Consortia (RTEC).
See ***http://www.ncrtec.org/capacity/guidewww/basic.htm*** and ***http://www.ncrtec.org/capacity/guidewww/gqhome.htm***

Learning through Technology, A Planning and Implementation Guide, North Central Regional Educational Laboratory.
See ***http://www.ncrel.org/tandl/homepg.htm***

## *Technology plans*

"Teaching and Learning for Tomorrow: A Learning Technology Plan for Maine's Future," State of Maine, 119th Legislature, January 2001.
See ***http://www.state.me.us/governor/news/previous_articles/PressReleases/MLTE.pdf***

Michigan Department of Education, State Technology Plan.
See ***http://www.michigan.gov/documents/miplan2000_40662_7.pdf***

## *In-depth resources*

*From Now On, the Education Technology Journal.*
See ***http://www.fno.org/fnoindex.html#Technology***

National Center for Technology Planning.
See **http://www.nctp.com/**

*"The public is looking for a return on its investment, and it rightly should."*

**Lowell Milken**, president and co-founder of the Milken Family Foundation, commenting on the $5 billion annual public expenditure on K-12 education technology

# Chapter 2

## Finance

### What to Expect From This Chapter

- Resources and ideas about assessing Total Cost of Ownership (TCO) and Return on Investment (ROI)
- Rules of thumb for technology replacement
- Ideas for managing to support technology
- Suggestions for adequate budgeting and technology funding
- Considerations in financing technology purchases

**"Understanding Total Cost of Ownership"**

Excerpted from "Technology's Real Costs," by Sara Fitzgerald

TCO can vary among companies, and different consultants use different formulas to calculate it. In most cases, though, TCO combines the "hard costs" of operating a network—including, for instance, the costs of training employees, maintaining a help desk and support staff, and repairing computers—with some calculation of "soft costs," namely the loss in productivity when users have to stop and fix their own computers or the network is down because of poor maintenance.

School districts, of course, are different from businesses and make their budgeting decisions based on very different factors. Nevertheless, even if a school district is not in a position to analyze its Total Cost of Ownership in a formal way, school leaders still need to understand all of the costs involved with operating computers if they are going to use them to their full advantage—and cost-effectively.

In 1997, International Data Corporation surveyed some 400 schools and calculated that the Total Cost of Ownership for a school with approximately seventy-five computers was $2,251 per computer annually.

## Key Questions for This Chapter

1. How does your school district compare in technology expenditures with others in your state?
2. How much was spent in the past academic year for instructional and administrative equipment purchases?
3. How much was spent for instructional and administrative applications and software?
4. How much was spent for maintenance and support?
5. How much was spent for instructional and administrative professional development?
6. How much was spent for connectivity and infrastructure?

## Overview

Installing and managing technology in schools involves allocating (and reallocating) resources. Educational decision making almost always leads to decisions about resource allocation. In the planning process, budgets can inform the allocation of resources (budgeting as a part of technology planning is covered in Chapter 1). Knowing what has been expended supports future planning by comparing prior inputs to expenditures and allows decisions to be made about relative priorities. What to include in expenditures for technology, and how to organize the information, is what this chapter is about.

Awareness of the financial obligations associated with technology implementation and maintenance can go a long way toward ensuring two important management goals. First, budgets must be adequate to reliably support the technology system as designed. Second, a financial plan must include the necessary funding to replace technology components as they become obsolete. The lack of either of these key ingredients in the budgeting process will ultimately result in a technology system that does not function as an effective tool and can actually become a political liability to a school system. School districts would then be forced to deal with a significant decision-making issue in explaining to the community the rationale for the original technology expenditures.

This chapter provides suggestions and resources to assess expenditures for technology. Answering the key questions for this chapter amounts to estimating the annual share of a school or district's Total Cost of Ownership (TCO) for technology. TCO is a concept from the business world that is applied to the lifecycle costs of computing, usually standardized as a ratio of costs per equipment unit, such as a desktop computer (see sidebar "Understanding Total Cost of Ownership" that begins on the facing page for a discussion of its application in schools). The TCO concept can assist educational leaders to understand more clearly the costs required to successfully implement educational technology. A number of TCO support instruments and discussions can be found online: the Consortium for School Networking (CoSN) offers "Taking TCO to the Classroom" (***http://www.classroomtco.org***); other resources can be found at ***http://www.iteg.com/tco.htm***.

Another important concept is return on investment (ROI). More important in administrative than in instructional applications, ROI analyses usually focus on the amounts of money saved by implementing technological advances or innovations. An example of such analyses can be found in a report to the San Diego City Schools Board recommending adoption of an electronic form (see ***http://www.sdcs.k12.ca.us/board/reports/2001/br.011127/e1a.pdf***).

There are two aspects to the financing of technology (or any entity, for that matter): expenditures and revenues. Revenues would be fairly straightforward to discuss, but are less germane to financial analyses for technology than expenditures. For the present, this chapter restricts its consideration of technology finances to expenditures.

## Defining Finance Terms and Categories for Technology in Schools

School financial systems are not particularly well configured to identify and present the costs associated with deploying, maintaining, and upgrading technology in schools. Categories used for budgeting in connection with technology planning overlap poorly with the major categories used in school accounting. The end result of these two different approaches is ongoing difficulty in reconciling technology expenditures with school financial reports.

Local and state requirements affect financial reporting practices, arguably more than they do any other area of data collection. The data elements available for analysis, and the way they are treated to produce reports, can vary widely within the bounds of generally accepted accounting principles (GAAP). This applies with

This result compared very favorably with a business of the same approximate size that indicated an annual TCO of $4,517 per computer.

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particular force to the following aspects of cost accounting: the general allocation of functions to programs; the allocation of costs for equipment purchases and support services; the definition of indirect costs; and the definition of bases for the allocation of indirect costs. Cost assignment and depreciation schedules for equipment are particular issues.

### TERM DEFINITIONS AND CATEGORIES

**Account classification structure**: For the purpose of defining data elements in the financial area, there are two sorts of financial transactions or activities: **revenues** and other sources of funds; and **expenditures** and other uses of funds. Both revenues and expenditures have a number of aspects or dimensions:

- Revenues: fund; revenue source; project/reporting code.
- Expenditures: fund; program; function; object; project/reporting code; level of instruction; operational unit (building); subject matter; job classification; special cost center.

**Fund**: A fiscal and accounting entity with a self-balancing set of accounts recording cash and other financial resources. It also contains all related liabilities and residual equities or balances. Funds are established to carry on specific activities or attain certain objectives of a local education agency (LEA) according to special legislation, regulations, or other restrictions. Seven fund types are recommended in *Financial Accounting for Local and State School Systems, 1990* (NCES 97-096R):

- general fund;
- special revenue funds;
- capital projects funds;
- debt service funds;
- enterprise funds;
- internal service funds; and
- trust and agency funds.

**Revenue source**: Primary classification differentiates local, intermediate, state, and federal revenue sources. Revenues from restricted sources would be further classified using project/reporting codes. For some revenue source categories of possible interest to technology in schools, see pp. 81–82 of *Financial Accounting*.

Note: The Finance Task Force of the Forum is working to revise *Financial Accounting*; it is expected that some of the categories will be expanded, and definitions will change, as the task force's work progresses.

## Key Questions and Indicators

The key questions and indicators for this chapter relate to annual expenditures for items covered in other handbook chapters. Technology planners and administrators may want to refer to the relevant chapter for the development of further budgetary indicators. The time period of a year which the key questions imply is arbitrary; a different time period may be chosen, such as 5 years or less.

The important point of the indicators is that measurement units are ratios, such as expenditures as a percentage of amount budgeted, or amount spent per

### The story of Jane Neussup continues...

***Finance***

John Techno has left Dr. Neussup a copy of the most recent technology plan implementation report, containing financial data for the previous school year. Impressed with John's efforts, Dr. Neussup calls to ask him to prepare an update presentation for the School Board on the status of the district technology plan and the expenditures per student to date to meet the goals of the plan. "Why don't you include a comparison to the technology expenditures of some other districts in the state that look like Freshlook County?" she suggests.

Knowing that the next School Board meeting is only two weeks away, John sighs. Now, how can he get data on other counties, and what would make them comparable?

Lost in thought, he forgets to tell Dr. Neussup that he has an appointment to meet with the Science Department head at Freshlook High School, to answer the other question she's put to him.

[To be continued...]

student, per teacher, or per building. Raw numbers are not interpretable without context, and creating uniform indicators such as those below allow data to be compared.

Classifying expenditure indicators as capital or consumable is complicated by the fact that coding thresholds differ widely from one state to another, and sometimes even within states. (See the sidebar to the right on differing thresholds.)

### *Key Question 1. How does your school district compare in technology expenditures with others in your state?*

The first thought that occurs to technology planners and administrators when facing the costs of technology programs is whether or not their expenditures are comparable to those of other schools and districts. There are a variety of indicators that can be used for making comparisons; alternatives are detailed in the indicators below. Schools can also compare their expenditures to those of other schools in their district, regardless of school size, or they can choose comparable schools in other districts in their state.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditure comparisons for technology equipment | Expenditures for administrative equipment as a percentage of total technology expenditures. |
| | Expenditures for instructional equipment as a percentage of total technology expenditures. |
| | Average expenditures for instructional equipment per student, per teacher, per building. |
| | Average expenditures for administrative equipment per building. |
| Expenditure comparisons for technology applications | Expenditures for administrative software as a percentage of total technology expenditures. |
| | Expenditures for instructional software as a percentage of total technology expenditures. |
| | Average expenditures for instructional software per student, per teacher, per building. |
| | Average expenditures for administrative software per building. |

### "Are computers a capital or consumable expense?"

Under some state threshold coding rules, computers are considered a consumable supply and therefore have a simple purchase process, while under other rules they are a capital expenditure and need district-level authorization, etc.

Note: All numbers refer to the year 2000 or earlier.

**Alabama**: $500 capital threshold statewide.

**Alaska**: Criteria for distinguishing capital equipment from supply items: cost exceeds $500; must be an independent unit rather than a part incorporated into another unit; is cheaper to repair than replace; and the cost of tagging and inventory is a "small percent"...

**California**: Specific dollar level is left to discretion of LEAs. State guidelines for classification as capital vs. supply include the following: does item lose original shape and appearance with use; does it have a normal service life of less than two years; is it easily broken, damaged...

**Colorado**: Dollar thresholds for capital are left to LEAs to establish, provided item does not exceed $5,000. District's fixed assets policy establishes criteria for when equipment must be capitalized and included in district's property inventory records.

**Connecticut**: Minimum threshold of $1,000. Technology is not treated any differently.

**Florida**: $750 threshold.

**Georgia**: Use expectancy of less than 2 years and costs of less than $2,000.

**Hawaii**: N/A, since all funding is from state and federal sources.

INDICATORS *(continued)*

| | |
|---|---|
| Expenditure comparisons for maintenance and support | Expenditures for maintenance and support as a percentage of total technology expenditures. |
| | Average expenditures for maintenance per student, per computer, per building. |
| | Average expenditures for support personnel per student, per computer, per building. |
| Expenditure comparisons for professional development | Expenditures for administrative professional development as a percentage of total technology expenditures. |
| | Expenditures for instruction-related professional development as a percentage of total technology expenditures. |
| | Average expenditures for instructional professional development per student, per teacher, per building. |
| | Average expenditures for administrative professional development per administrative staff member, per building. |
| Expenditure comparisons for connectivity and infrastructure | Average expenditures for connectivity per student, per building. |
| | Average expenditures for infrastructure upgrades per student, per building. |

## *Key Question 2. How much was spent in the past academic year for instructional and administrative equipment purchases?*

Probably the most important aspect of tracking equipment costs is the replacement cycle that the indicators below cover. (Coding would most likely not differentiate between replacing obsolete equipment and purchasing new equipment.) It may be helpful for technology planners and finance professionals to keep in mind that the generally accepted life cycle of equipment is about five years in education versus two to three years in business, though different schools and programs may have shorter cycles (for instance, laptops will have shorter replacement cycles than desktop machines). Also, a replacement cycle may not apply to some indicators that this key question includes, such as leasing equipment and server space.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditures for instructional technology equipment | Expenditures as a percentage of the amount originally budgeted. |
| | Average expenditures for instructional equipment per student, per teacher, per building. |
| Expenditures for administrative technology equipment | Expenditures as a percentage of the amount originally budgeted. |
| | Average expenditures for administrative technology equipment per building. |

## *Key Question 3. How much was spent for instructional and administrative applications and software?*

Indicators include software purchases, leases, and service subscriptions, including online content services. Software upgrades are most likely not distinguishable from new software purchases. The school's approach to software purchases, as well as the professional development and knowledge level of instructional staff, are likely to markedly affect these costs.

More detail on software purchasing patterns (for instance, separating expenditures for system-wide licenses from those for individual class or school subscriptions, and from expenditures for one-time purchases) and separation of general instructional technology costs from administrative or instructional software and systems expenditures might be clearly desirable. Separating out expenditures for classes of administrative software (by major business function) or instructional applications (by grade level or curriculum area) might also be desirable. However, it is unlikely that such information will be obtainable from currently available financial categories.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditures for instructional technology applications | Expenditures for instructional software as a percentage of total expenditures for instructional materials. |
| | Average expenditures for instructional software per student, per teacher, per building. |
| | Instructional software expenditures as a percentage of the amount originally budgeted. |
| Expenditures for administrative technology applications | Expenditures for specialized administrative technology applications as a percentage of amount originally budgeted. |
| | Average expenditures for software per building. |

## Key Question 4. How much was spent for maintenance and support?

These indicators include overall maintenance, personnel, and support contracts. Maintenance and support expenditures may be difficult to precisely ascertain because teachers and even students may be doing maintenance on a volunteer basis, or as staff hired only to perform those duties. Loss of productivity is another aspect of maintenance and support that may or may not be able to be determined or even considered in expenses. The important factor to quantify for any school district in maintenance and support is the cost per student and ratio of support personnel to computers.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditures for maintenance and support | Expenditures for technology support personnel as a percentage of the amount originally budgeted. |
| | Expenditures for maintenance agreements and contracts as a percentage of the amount originally budgeted. |
| | Expenditures for replacement components as a percentage of the amount originally budgeted. |
| | Average expenditures for overall maintenance and support per student, per building. |

## Key Question 5. How much was spent for instructional and administrative professional development?

The indicators below include contracts, personnel, and reimbursement. One difficulty of ascertaining the costs of professional development for technology is differentiating those costs from those for staff development in general. See Chapter 6 for further discussion of this topic, including the need to quantify training by context. Job-specific training is key to successful programs, and the need to present or perform certified technology skills in order to advance may help make some professional development programs more effective.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditures for instructional professional development | Expenditures for training materials such as videos and related publications as a percentage of total expenditures for instructional professional development. |
| | Expenditures for external consultants as a percentage of total expenditures for instructional professional development. |
| | Expenditures for presentations and workshops delivered in district, as a percentage of total expenditures for instructional professional development. |
| | Average expenditures for professional development per teacher, per building. |
| Expenditures for administrative professional development | Expenditures for training materials such as videos and related publications as a percentage of total expenditures for administrative professional development. |
| | Expenditures for external consultants as a percentage of total expenditures for administrative professional development. |
| | Expenditures for presentations and workshops delivered in district, as a percentage of total expenditures for administrative professional development. |
| | Average expenditures for professional development per administrative staff member, per building. |

## *Key Question 6. How much was spent for connectivity and infrastructure?*

This indicator covers line charges, subscriptions for system software, and contracts with Internet service providers (ISPs). However, some connectivity and infrastructure costs can relate to specific technology facilities' requirements, such as HVAC, security and electrical capacity expansion, and even lead and asbestos abatement. See Chapter 1, Technology Planning and Policies, for an explanation of planning for these costs.

It is particularly important for this key question to separate capital investment costs—that is, non-recurring expenditures such as wiring or rewiring, the purchase and installation of wireless components and communications servers—from annual, recurring expenditures such as Internet access provision.

INDICATORS *(for term definitions and categories, see page 20)*

| | |
|---|---|
| Expenditures for connectivity and infrastructure | Expenditures for telecommunications and Internet access as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure. |
| | Expenditures for networking maintenance agreements and contracts as a percentage of original amount budgeted, as a percentage of total expenditures for connectivity and infrastructure. |
| | Expenditures system or network monitoring software as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure. |
| | Average expenditures for connectivity per student, per teacher, per building. |

## Unit Record Structure

The unit records below reflect the many levels at which finances are typically analyzed, based on the category of expenditure and record time period. These are units of measurement that would be determined by technology planners and/or administrators according to their own school or district's needs.

### EXAMPLE OF UNIT RECORD STRUCTURE: SAMPLE UNIT RECORD FOR ANNUAL TECHNOLOGY EXPENDITURES

**Direct technology expenditures:**

- Expenditures for new computers (LEA total, building total, per pupil)
- Expenditures for upgrades to existing computers (LEA total, building total, per workstation, per pupil)
- Expenditures for maintenance and support to existing computers (LEA total, building total, per workstation, per pupil)
- Expenditures for new software (LEA total, building total, per workstation, per pupil)
- Expenditures for updates to existing software (LEA total, building total, per pupil)
- Expenditures for network access (LEA total, building total, per pupil)
- Expenditures for dedicated technology personnel and support (LEA total, building total, per workstation, per pupil)

**Professional development expenditures:**

- Average cost of professional development:
  - Total for district
  - Per building (by type: high school, middle school, elementary school, special unit, administrative)
  - Per teacher-hour received
  - Per administrator-hour received
  - Per teacher
  - Per administrator
  - Per student

# Resources

Fitzgerald, S. (1999). "Technology's Real Costs," *Electronic School.* See **http://www.electronic-school.com/199909/0999sbot.html**

Levinson, E., and Surratt, J. (2000). "Four Figures to Know When Calculating TCO," abstracted from "Buying Technology Using Good Horse Sense," *eSchool News.* See **http://www.eschoolnews.com/news/showStory.cfm?ArticleID=1495**

U.S. Department of Education, National Center for Education Statistics. (1990). *Financial Accounting for Local and State School Systems, 1990* (NCES 97-096R). Washington, D.C.: U.S. Government Printing Office. See **http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=97096r**

U.S. Department of Education, Office of Educational Research and Improvement. (1998). *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms* (ORAD 1999-1200). Washington, D.C.: U.S. Government Printing Office. See **http://www.ed.gov/pubs/EdTechGuide/**

U.S. Department of Education, National Center for Education Statistics. (1999). *Best Practices for Data Collectors and Data Providers* (NCES 1999-191). Report of the Working Group on Better Coordination of Postsecondary Education Data Collection and Exchange, National Postsecondary Education Cooperative. Washington, D.C.: U.S. Government Printing Office. See **http://nces.ed.gov/pubs99/1999191.pdf**

## *Estimation tools*

Technology and Facilities Modification Investment Worksheet, Integrated Technology Education Group, LLC, for the National Center for Supercomputing Applications. See **http://www.ncsa.uiuc.edu/IDT**

## *In-depth resources*

*Taking TCO to the Classroom*, Consortium for School Networking. See **http://www.cosn.org/initiatives/**

Understanding the Total Cost and Value of Integrating Technology in Schools. An IDC White Paper Sponsored by Apple Computer, Inc. (1997). See **http://www.apple.com/education/k12/leadership/LSWTF/IDC.html**

*"..With the many hundreds of millions of dollars federal and state agencies are flowing into technology for schools, the cry for more research and evaluation will get very loud.... My fear is that high stakes evaluation will focus on the technology and not on what people are trying to do with it or how learning and instruction change through the use of technology—these are the far more interesting and important questions."*

**David Dwyer**, former director of the Apple Classrooms of Tomorrow project and currently Apple's Director of Education Technology. Excerpted from "Taking Stock: What Does the Research Say about Technology's Impact on Education?" in the May 1998 issue of *Technology & Learning Magazine*

# Chapter 3

## Equipment and Infrastructure

### What to Expect From This Chapter

- Resources and ideas for describing equipment and infrastructure availability and accessibility
- Understanding issues of availability in school or district technology programs
- Suggestions for structuring equipment records

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## Key Questions for This Chapter

1. Is equipment present in instructional settings?
2. Is equipment available for use by students?
3. Is equipment available for use by teachers?
4. Is equipment available for use by administrators and support staff?
5. Does the infrastructure have the capacity to support the school's technology needs?

## Overview

Many of the questions about technology that schools or districts must answer concern the types and amounts of equipment and infrastructure that a school has. Schools and districts need to count and keep track of hardware in order to answer such questions. This chapter provides guidance for responding to these kinds of questions, including equipment availability to users. It also addresses the connection of computers and video equipment to networks and to the Internet—the requisite infrastructure that allows users to share information electronically.

Much information can be drawn from a school district's inventory system. If an inventory system is set up with the capacity to produce useful reports, and is maintained routinely, surveys may take minutes instead of days to complete. The information that should be included in a database system to provide this capacity follows.

Indicators are provided both for the presence of computers and other technology resources in school administrative and instructional settings and for the availability of these resources to teachers, students, and administrative staff.

Indicators do not cover all the possible kinds of equipment that one might find in schools because the intent of this handbook is to describe and suggest, not prescribe. Enough are provided to serve as examples for developing other indicators, as well as data elements. Obviously, the list of indicators will require updating over time, to allow for new technologies and types of equipment that diffuse into school settings.

### The story of Jane Neussup continues...

***Hardware***

As John heads back to his office, he is stopped by Martha, Dr. Neussup's secretary. She is trying to fill out a survey.

"The question," she tells John, "is what is the number of students per up-to-date computer in grades 4 through 6?"

John is perturbed with the survey question. While it sounds simple, he needs much more information to give an accurate answer. "Martha, did they give you any more specifics?" he asks. She replies, "Yes, they said 'connected to the Internet and for the exclusive use of students.'"

John is relieved. "No problem, I think I can query the inventory on the connected computers in classrooms for grades 4 through 6 to get the answer to this question. While I'm at it, I think I'll do a report for Dr. Neussup on our hardware expenditures for the past five years."

"Wait," Martha says, "don't rush off yet. There's another survey question."

[To be continued...]

# Defining Equipment and Infrastructure

The terms **equipment** and **infrastructure** in this chapter refer to computer hardware and associated communications equipment and cabling, as well as other technology-related equipment regularly used in schools. Indicators address the availability, capabilities, and connectivity of computer equipment and infrastructure.

Computer **equipment** refers to both computers and associated peripheral equipment, such as:

- computers, including desktop and laptop machines, but extending to handheld computers (also known as Personal Digital Assistants, or PDAs), mainframe machines, and other specialized computing devices; and
- peripheral equipment that may be attached to computers, such as monitors, keyboards, disk drives, modems, printers, scanners, cameras, and speakers.

Other technology resources in the school setting are also included, such as:

- network devices—routers, hubs, switches, access servers;
- communications support, such as fax-back and voice-mail resources in regular use by instructional and administrative staff;
- videoconferencing and other distance education tools, including satellite transmitters and receivers, cable-based receivers, and modem or codec-based video equipment;
- projection devices, from transparent and opaque projectors to video monitors; and
- graphing calculators and other specialized computational aids.

The term **infrastructure** covers both devices and cabling. Devices supporting technology in schools include specialized equipment (such as switches, routers, modems, or codecs) that link computers or video hardware to networks. Infrastructure also refers to cabling, whether wire, fiber optic, or coaxial. In newer systems, links between computers are wireless, in which case infrastructure refers to receivers and transmitters.

For schools to use technology, they must first have it and make it available for students, teachers, and administrative staff. Acquiring that technology, from computers to modems to two-way conferencing equipment, is only one step in facilitating student learning. Curriculum integration and professional development are also essential components in this process.

**"Presence, Access, and Availability"**

Users should keep in mind that presence is not the same as availability. Knowing the percentage of classrooms with computers does not necessarily indicate how many students use them, for example. Although direct assessments of actual use by students would be the most desirable indicator of availability, such measurement may be difficult to obtain.

Availability, for the purposes of this handbook, means that students, teachers, or administrative staff have access to, or can use, the technology in question, whenever needed.

Access to current technologies, software, and telecommunications networks has been listed as an essential condition for both teachers and students to make use of technology as a powerful learning tool by the International Society for Technology in Education's (ISTE) National Educational Technology Standards (NETS). (See Resources for reference.)

# Key Questions and Indicators

Counting equipment might seem a straightforward assignment, but it can quickly become complex. Technology administrators will want to determine what qualifies a piece of equipment to be counted or not. They must pay careful attention to whether technology resources are actually available to their intended users when needed. See the sidebar on "Presence, Access, and Availability."

The key questions below address two issues: Are appropriate technology resources available, and are they accessible to their intended users?

## *Key Question 1. Is equipment present in instructional settings?*

This question deals with the availability of up-to-date equipment (and its supporting infrastructure). User access is addressed in the following key questions. Restriction to **up-to-date** or **multimedia** computers addresses the issue of whether the installed computer base is appropriate to current usage demands. In the listed indicators, whenever computers are mentioned, only up-to-date computers are included.

INDICATORS *(for term definitions and categories, see next page)*

| | |
|---|---|
| Computers in instructional settings | Percentage of instructional settings with one or more computers. |
| | Average numbers of up-to-date computers per instructional setting, by age grouping of computers. |
| | Percentage of instructional settings with one or more multimedia computers. |
| | Average number of multimedia computers per instructional setting, by age grouping of computers. |
| | Percentage of instructional settings with one or more computers connected to the Internet, by type of connection. |
| Other technologies in instructional settings | Availability of communications support for instructional staff: telephone access; voicemail in regular use for instructional support; fax or fax-back capabilities in regular use. |
| | Availability of two-way videoconferencing capability, or other distance education technology, in the school building (by capability type). |
| | Percentage of instructional settings with two-way videoconferencing capability. |

INDICATORS *(continued)*

| | |
|---|---|
| Other technologies in instructional settings *(continued)* | Regular use of graphing calculators in at least one course in the school (yes, no).<br>[Note: This and other questions related to graphing calculators apply primarily to mathematics or science courses in middle or high schools.] |
| | Percentage of instructional settings with graphing calculators in regular use. |
| | Average number of students per graphing calculator, per instructional setting in which graphing calculators are in regular use. |
| | Percentage of instructional settings with dedicated external input devices, by type of device. |
| | Percentage of instructional settings with broadcast video receiving equipment (cable-connected monitors), by type of device. |
| | Percentage of instructional settings with projection device, by type of device. |
| | Percentage of instructional settings with dedicated printer. |

### "Usage Tip"

If you are building your own database inventory system, consult the detailed list of data elements for this chapter's indicators contained in Appendix A, as well as the resources listed at the end of the chapter.

TERM DEFINITIONS AND CATEGORIES

**Bandwidth**: Example ratings for bandwidth amount: 33.6 KBPS or under; 56 KBPS; 128 KBPS; 256 KBPS; 512 KBPS; 768 KBPS (.5 T1); 1.544 MBPS (T1); Ethernet; DS(1) or higher.

**Broadcast video receivers**: Example of broadcast video receiving device types: closed-circuit building-level cable system, external cable system.

**Connection types**: Refers to the kind of link between a computer and external networking resources. Example of connection types: dial-up via modem; wired LAN and router; wireless LAN and router; cable modem; satellite/modem hybrid link; full satellite (two-way) link.

**External input devices**: Example of dedicated external input device types: videocassette recorder, digital video disk, compact disk (various formats).

**Instructional setting**: Includes both regular classrooms and computer laboratories.

**Multimedia computer**: Refers to computers capable of running Windows 95 or Macintosh OS8.0 or later operating systems, with chipsets such as Pentium (200 MHz) or PowerPC 200 MHz or Imac G3 or better, with at least 64MB of random-access memory (RAM), with CD-ROM or DVD player, and with a sound card, manufactured in the 5 years prior to data collection.

**Projection devices**: Example of projection device types: large monitor, overhead opaque projector, computer projector or electronic whiteboard, overhead transparency projector.

**Up-to-date**: Computers manufactured in the 5 years prior to data collection. Example rating for computer age groupings: 0-12 months between manufacture and data collection; 13-36 months between manufacture and data collection; and over 37 months.

**Videoconferencing/distance education equipment capability**: Example of types: dedicated room or facility; in one or more classrooms, no capability in building.

Note: These definitions will necessarily change in order to encompass prevailing standards as technology progresses.

**Instructional settings** can be more than classrooms. Instructional settings include regular classrooms and computer laboratories, but any setting in which instruction takes place could be considered within this category, such as "pull-out" rooms for remedial or special education, for instance. Media centers (what used to be called libraries) might be included, as well as specialized laboratories (chemistry labs, for instance) or rooms dedicated to distance education. It is even possible that some instruction may take place off-campus and therefore be included as a setting in this category, especially in the case of laptop loan or grant programs.

The presence of multimedia computers is an important indicator of technology capability. Such computers allow the user to display images, video, and sound as well as text, and therefore create opportunities for learning from a variety of media resources, or from resources that use these capabilities simultaneously. More exciting is the prospect that students can create multimedia reports and presentations (as well as other resources) themselves. Depending on the subject matter and teachers' preferences, such capabilities can expand the repertory of student capacities and create useful skills and forms of expression for use later in life.

## *Key Question 2. Is equipment available for use by students?*

The general question of access to multimedia computers, and to computers connected to networks and the Internet, has been addressed in the previous key question. Indicators for the present key question deal with student access, both to computers generally and to more specialized computer resources. Since access to multimedia computers and to those connected to the Internet can impact educational achievement, it may be important to understand the extent to which such computing resources are actually available.

Computers referred to in this key question are only those to which students have preferential access; the count does not include computers used for administrative purposes or for the exclusive use of teachers. As before, when the term computer is used, the reference is to up-to-date computers.

If computer labs are a prominent component of technology access in a given district or school, it may be important to collect additional information. Indicators for the amount of time in the school week that students spend in the computer lab, or for the percentage of classes that regularly use the computer lab, may provide more detail to round out the picture of access.

INDICATORS *(for term definitions and categories, see page 33)*

| | |
|---|---|
| Computers for use by students | Average number of students per computer (dedicated to student use) in instructional settings. |
| | Percentage of students without regular access to computers in school. |
| | Percentage of students with access to computers only in computer laboratories (i.e., outside of regular classroom setting). |
| | Average number of students per multimedia computer (dedicated to student use) in instructional settings. |
| | Percentage of students with regular access to multimedia computers (dedicated to student use) in instructional settings. |
| | Average number of students per Internet-connected computer (dedicated to student use) in instructional settings. |
| | Percentage of students with regular access to Internet-connected computers (dedicated to student use) in instructional settings. |

### *Key Question 3. Is equipment available for use by teachers?*

This question refers to computers reserved for the exclusive use of teachers, where use is not generally shared with students. This is an important issue: computer-based curriculum planning and instructional management are much more likely to take place if teachers have dedicated computers exclusively for their use, because teachers have access to the resources when and where they are needed. Similarly, it is important to know if teachers have access to portable ("laptop") computers, since their work will often be done at home after the school day. Note, again, that the reference to computers implies that they are up-to-date.

A reviewer pointed out that, in situations where teachers can dedicate any computer in a school network to their exclusive use simply by entering their username and password, questions about computers reserved for the exclusive use of teachers might be confusing. The confusion can be resolved if it is understood that the intent is to assess teacher access to computing: if a teacher can only use a computer if no student wants it, he or she does not have dedicated access. There might be excellent access for everyone in such a situation, which can be assessed by the overall ratio of computers to instructional settings, but it will not be dedicated access.

More detail on the use of technology by teachers might be obtained by asking whether the same software (say, an electronic gradebook or curriculum support software) is available at home as at work. This question might be more properly addressed under the key questions of Chapter 4, Technology Applications, or Chapter 7, Technology Integration.

INDICATORS *(for term definitions and categories, see page 33)*

| | |
|---|---|
| Computers for use by teachers | Percentage of teaching staff with access to a computer for instructional use, by location of access (at school, at home). |
| | Percentage of teaching staff with their own (dedicated) computer at school. |
| | Percentages of teaching staff with their own dedicated computer at school, by computer capabilities (multimedia, not multimedia). |
| | Percentages of teaching staff with their own dedicated computer at school, by computer type (desktop, laptop). |
| | Teaching staff are allowed to take school-provided computers to their homes outside of school hours (yes, no). |
| | Percentages of teaching staff with their own dedicated computer at school, by age groupings of computers. |

## *Key Question 4. Is equipment available for use by administrators and support staff?*

Decision support systems call for computers. School leaders and support staff need computers to use data management systems which in turn can have great impact on decision making, improving educational management and, ultimately, student care and performance. It makes no sense to provide technology to support instruction and not for support of school management functions.

Creating an integrated management system can benefit all users in a school or district; information can usefully flow both from the teachers and the classroom to administrators, and from school management to instructional staff. For example, computer-based attendance systems allow for immediate administrative action upon a teacher recording an absence (i.e., a follow-up telephone call to the home or parent that same morning). Likewise, aggregate information on absences, health condition, and test results for a given student may help a teacher make educational decisions.

Users might want to break down administrative and support staff into narrower categories, such as student support personnel (counselors, social service specialists, health personnel), administrative support staff (transportation coordinators, attendance officers, dietitian/cafeteria manager), or leaders (principal, assistant principal, etc.).

INDICATORS *(for term definitions and categories, see page 33)*

| | |
|---|---|
| Computers for administrative and support staff | Percentage of administrative or support staff with a dedicated computer. |
| | Percentages of administrative or support staff with a dedicated computer, by computer capabilities (multimedia, not multimedia). |
| | Percentages of administrative or support staff with a dedicated computer, by age groupings of computers. |
| | Percentages of administrative or support staff with a dedicated computer with Internet access, by type of connection. |

## *Key Question 5. Does the infrastructure have the capacity to support the school's technology needs?*

Connection to a school local-area-network (LAN) or, through such a network, to a district-wide wide-area-network (WAN) greatly expands what can be done with a computer. Access to shared resources such as printers or shared memory, or to electronic mail, or to specialized instruments or computing devices, can support collective work and increase the efficient use of resources. Access to the Internet opens up a whole world of riches, with attendant risks. A limiting consideration is the amount of bandwidth (the term refers to the amount of information that can traverse the network each second) available to each computer.

INDICATORS *(for term definitions and categories, see page 33)*

| | |
|---|---|
| Capacity of infrastructure | Percentage of instructional settings with one or more computers connected to a network. |
| | Ratio of persons (instructional staff) to dedicated computers connected to a network. |
| | Ratio of persons (administrative or support staff) to dedicated computers connected to a network. |
| | Availability of bandwidth to building for access to network and external sources. |
| | Availability of bandwidth to desktop(s) for access to Internet and other online resources. |

## Unit Record Structure

Almost all of the indicators just discussed can be derived straightforwardly from a school district's inventory and maintenance system for technology equipment. Many school districts already have such computerized systems.

The data elements listed below could form the basis of a comprehensive technology equipment database. At the core is the notion of a unit record—a uniform record kept for each identifiable unit. In this chapter, for example, a single piece of equipment would constitute one unit on which records would be kept.

A system based on unit records would meet day-to-day administrative needs and support overall assessment and planning—as well as providing data to answer some of the most usual survey questions. These suggested records are not intended to define data collection. Instead, they illustrate basic units of a data system from which data elements and indicators can be derived to answer important policy and planning questions.

The following list of data elements, along with others defining basic school components such as classrooms and adapted from other NCES handbooks, can be used to create the indicators listed in this chapter. The complete list of data elements for this guide can be found in Appendix A; a number of detailed examples illustrating the creation of indicators from data elements can be found in Appendix B.

LIST OF POTENTIAL DATA ELEMENTS FOR A UNIT RECORD: SAMPLE UNIT RECORD FOR TECHNOLOGY-RELATED EQUIPMENT

**For each computer or server, or associated peripheral equipment:**

General information: CPU ID code; brand and model; CPU serial number; school/district inventory number; machine type (workstation, desktop, laptop)

Vendor name; vendor address; vendor contact number

Date acquired; date installed; cost; source of funds

Location information: building location ID code, if fixed location; assigned primary user ID code, name, user type (student, instructional staff, administrative, or support staff)

CPU processor chip

Random access memory (RAM) size

Hard drive size

Operating system

Network connection characteristics (standalone, LAN, wired WAN, wireless WAN); network address (IP or MAC address)

Internet access (none; dialup modem, bandwidth); wireless (bandwidth); DSL/ADSL (bandwidth outbound); cable modem (bandwidth); fractional T1, T1; DS3, OC3, ATM/frame relay)

Disposition variable

[There will also be information on software and applications installed; see Chapter 4 unit record description.]

[There will also be information on maintenance and repair history; see Chapter 5 unit record description.]

Warranty/support package expiration date

Technical support entity

Technical support entity address

Technical support contact number

Other components in system (monitor; printer(s); DVD; CD-ROM; floppy drive; superdrive; ZIP drive; network card; video camera; other installed cards). For each:

- Serial number
- Date purchased; date installed
- Cost
- Warranty/support package expiration date
- Vendor name; vendor address; vendor contact number
- Disposition variable

**For other (non-computer) equipment:**

Equipment types (sample list): graphing calculators; electronic whiteboard; videotape player/recorder; DVD player; transparency projector; computer screen projector; opaque projector; cable system monitor; room monitor; two-way videoconferencing system; other equipment (specify)

Brand and model; serial number

Vendor name; vendor address; vendor contact number

Date manufactured; date purchased; date installed; cost; source of funds

Network connection characteristics, if any (standalone, LAN, wired WAN, wireless WAN); network address

Disposition variable

Warranty/support package expiration date

Technical support entity; technical support entity address; technical support contact number

Records kept and aggregated at building or district level.

# Resources

*Education Week.*
Search for Special Reports: Technology Counts at **http://www.edweek.org**

International Society for Technology in Education (ISTE). *National Educational Technology Standards (NETS) for Students and for Teachers,* especially ESSENTIAL CONDITIONS.
See ***http://cnets.iste.org***

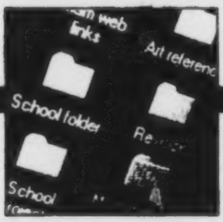
The Milken Family Foundation. (1999). "Results from a Study of 27 States' District Technology Coordinators, 1998–1999."
See ***http://www.mff.org/publications/publications.taf?page=277***

National Center for Supercomputer Applications (NCSA), North Central Regional Educational Laboratory (NCREL), and Integrated Technology Education Group (ITEG). (1997). *Building the 21st Century School.* Detailed information on design, wiring, equipment, and physical infrastructure modifications necessary for implementing technology within a school.
See ***http://archive.ncsa.uiuc.edu/IDT/index.html***

Salpeter, J. (1998). "Taking Stock: What Does the Research Say about Technology's Impact on Education?" *Technology & Learning Magazine.*
See ***http://www.techlearning.com/db_area/archives/TL/062000/archives/interv.html***

U.S. Department of Education, National Center for Education Statistics. (1997). *Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, Fall 1996* (NCES 97–944). Washington, DC: U.S. Government Printing Office.
See ***http://nces.ed.gov/pubs/97944.html***

U.S. Department of Education, National Center for Education Statistics. (2001). *Internet Access in U.S. Public Schools and Classrooms: 1994–2000* (NCES 2001–071). Washington, DC: U.S. Government Printing Office.
See ***http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001071***



*"Technology's a lot like the rungs on a ladder. Once you reach one level, there's another one higher up to aspire to."*

**Jess Stephens,** director of information technology, Campbell Union High School District, San José, California, speaking in "Teachers and Technology," in the fall 2001 issue of *Curriculum Update*, a newsletter of the Association for Supervision and Curriculum Development

# Chapter 4

## Technology Applications

### What to Expect From This Chapter

- Resources and ideas for evaluating technology applications in relation to management and instructional needs
- Suggestions for tracking applications and software through their useful life cycle
    - Suggestions for assessing applications in terms of their support for learning standards
    - What to look for in decision support and communication software
- Understanding the range and potential of technology applications in schools

## Key Questions for This Chapter

1. Do the school or district's instructional applications support teaching and learning standards across the curriculum?
2. Is there software support for technology tool skill development?
3. Does the school/district use technology applications to improve communication?
4. Does the school/district have appropriate software and systems to support primary administrative functions?
5. Are the applications in use evaluated for effectiveness?

## Overview

This chapter focuses on key questions and indicators to assess the presence and utilization of instructional and administrative technology applications. The subject matter of this chapter is primarily software, but also includes other applications that have come to be considered important to a school's mission: electronic mail and other communications technologies, Internet and web access including web pages, access to online content, and the capacity to securely transmit data, as well as security-related applications.

Assessing the presence and utilization of equipment is a necessary part of evaluating the impact of technology in schools, but it is hardly sufficient. A further step in assessment involves the extent to which applications important to schools' function are being run on this equipment.

As with hardware, enterprises (including schools and districts) have a number of important reasons for tracking the installed base of software and applications; making sure software is properly licensed and unlicensed software is not running on school system machines is just one of them. An inventory database of installed and permitted software and applications is a natural requirement for a school or district. If such an inventory system is properly maintained and can produce useful reports, responding to many questions can be straightforward. The information that should be included in a database system in order to support this capacity is the topic of this chapter.

**"Mission-Critical Applications for Schools"**

Computer-based technologies are in the process of becoming critical to achieving schools' mission. Areas in which applications may be considered mission-critical at present include:

- finance, including payroll, accounting, and budgeting;
- operations and planning, especially transportation management; and
- instructional management, including attendance and grading.

Other functions are equally important to schools, but carrying them out on computers is still not widespread enough to be considered "critical." These include instructional support; special education support (including both expanded accessibility for instructional resources and integrated education plan management); electronic mail; and communication with parents and community, especially via the web.

No attempt has been made to cover all of the possible types of software and applications that might be included. As with other chapters, enough indicators are given to provide examples; users can adapt these examples to their own school or district's situation, or develop new ones.

## Defining Technology Applications

The term **technology applications** refers to software and systems, run on school equipment, that support important administrative and instructional functions. The following functions represent the major categories of technology applications for schools and districts:

- **Administrative management software and systems:** Financial accounting; staff attendance and payroll; budgeting; operations and planning, including transportation and food systems; facilities management; inventory control; and decision support;
- **Instructional support software and systems:** Instructional planning and management, including grading, testing, and individualized educational program (IEP) management; instructional support, including student attendance; access to remote educational resources; and distance education. Also included are assistive and adaptive systems, discussed in Chapter 7, Technology Integration;
- **Communications support:** Electronic mail; local- and wide-area networks; access to the Internet and remote educational and administrative sites; satellite uplinks and downlinks; and Internet-based telephony ("voice over IP," or voIP);
- **Operating systems**; and
- **Security systems**, such as firewall technology, secure transmission systems, and antivirus software.

Indicators related to staff and student use of software, and training in the use of software, may be found in Chapter 6, Professional Development, and Chapter 7, Technology Integration. Indicators and data elements related to software budgeting, funding, and expenditures may be found in Chapter 2, Finance.

## Key Questions and Indicators

Four of the five key questions for this chapter address a single issue: Are software and applications systems appropriately addressing important school management and instructional functions?

### The story of Jane Neussup continues...

***Applications***

John is assisting Dr. Neussup's secretary, Martha, with a survey question that asks: "What state learning standards in grades 4 through 6 in reading and math are addressed using instructional software?"

John offers some advice. "Martha, remember that several of our elementary school principals reviewed our instructional software inventory last summer? They mapped the various packages we use to the state learning standards and found a 79% match between the software and support for standards. I think you can find the results of that work under 'Instructional Resources' on our web site."

Martha replies, "Thanks, John, I'll look there... just as soon as the network comes back up."

John flinches. This is not what he wants to hear right then. Retreating to his role as chief techie, he rushes back to the computer center to investigate the problem.

[To be continued...]

**"Usage Tip"**

If you are in the process of developing or purchasing a database or information management system for tracking technology in your school or district, and are not sure what entries should be included, you may sample the unit record lists of data elements in each chapter to decide what will best support the critical decisions you must make.

The first two questions deal with teaching and learning standards and basic technology tool skills; the next one addresses the use of (primarily computer-based) technology in support of communications. The fourth question deals with technology-based support of key administrative functions.

The fifth question addresses a different issue entirely: the existence of a process to assess software and applications. Software and applications, ideally, have a life cycle: specifically, there is a point in their installed life at which they need to be upgraded or replaced. Making this process systematic, or at least transparent to the community, is important for the intelligent use of technology. At this point, the only indicators suggested for this question deal with the existence of an evaluation process and the ratings categories used in performing the evaluation.

## *Key Question 1. Do the school or district's instructional applications support teaching and learning standards across the curriculum?*

This key question relates to software packages or applications (for instance, web-based applications) that directly support teaching and learning. Software packages such as those that support the teaching of reading or writing, or those that relate to specific mathematics or science skills and knowledge, are currently the ones most likely to have external ratings. There are commercial enterprises that rate software in terms of alignment with state and national standards (see sidebar "Commercial Sites Rating Software Alignment to Standards" on the facing page). It is also clearly possible for state or district groups to rate software packages in terms of their alignment with teaching and learning standards.

INDICATORS *(for term categories, see next page)*

| | |
|---|---|
| Alignment with teaching and learning standards | Existence and current status of software alignment plan (most likely at district or state level; may be for all subjects or for a specific curriculum area or grade). |
| | Alignment rating (for each application). |
| | Alignment measure (for each standard). |
| | Percentage of applications aligned to teaching and learning standards. |
| Approved instructional applications in regular use | Number of approved instructional applications in regular use, by subject area, grade, and type. |
| | Number of approved teacher-support instructional applications in regular use, by type. |

TERM CATEGORIES

**Existence and current status of software/applications alignment plan**: 0=no alignment plan exists; 1=an alignment plan is being developed; 2=an alignment plan has been approved; 3=an alignment plan is approved and is being implemented.

**Alignment rating** (for a single software/applications package; may be for alignment with standards for all subjects, or for a specific curriculum area or grade): 0=no alignment to standards exists for this application; 1=a weak alignment to standards exists for this application; 2=this application is somewhat aligned to standards; 3=a strong alignment to standards exists for this application; 4=this application is fully aligned to standards. [Note: judgment about relative strength of alignment to standards might be in terms of the extent of fit between software goals and one or more standards, or in terms of the number of standards addressed by a software package or application, or even in terms of the credibility of the rating organization.]

**Alignment measure** (for a single teaching and learning standard; may be for all subjects, or for a specific curriculum area or grade): 0=none of the applications in use in the school/district have been rated as fully aligned to a learning standard; 1=one application has been rated as fully aligned to a learning standard; 2=more than one application has been rated as fully aligned to a learning standard.

**Percentage of instructional applications aligned with one or more learning standards**: Number of applications with ratings of 3 or 4 (see "Alignment rating," above) divided by the total number of instructional applications and converted to a percentage. May be for alignment with standards for all subjects, or for a specific curriculum area or grade.

**Instructional application types**: Instructional process support (see also "Teacher-support instructional applications," immediately below); learning support (practice drills; problem solving; data analysis; simulation/demonstration; research; distance learning); assessment.

**Teacher-support instructional applications**: Software or applications specifically designed to support teachers in instructional processes. Examples include attendance software; grading applications; testing systems; student work or portfolio systems; lesson planning software.

## *Key Question 2. Is there software support for technology tool skill development?*

The basic tool skills that everyone involved in schools—from the principal to the teacher to the student—must have in order to be able to use technology range from simple keyboarding to computer programming. While some skills obviously vary in complexity and may not be needed until higher education, basic capabilities have become part of a new literacy. Knowing them is akin to learning how to read in an earlier age: the mark of an educated, competent person. Assessing the extent to which the school technology offerings teach these tool skills is very important and will no doubt become even more so as technology becomes more transparent in the classroom.

### "Commercial Sites Rating Software Alignment to Standards: An Example"

Cambridge Development Laboratories has developed Edumatch, a web site designed to allow administrators to determine whether the software they are interested in complies with their state curriculum standards. The site's proprietary search engine allows educators to describe the software they want and Edumatch finds it for them. Users can see precisely which standards, down to the substrand level, are addressed by every piece of software they've purchased and how every piece of software fits into each school's needs, by subject and grade level. See ***http://www.edumatch.com***

INDICATORS *(for term categories, see below)*

| | |
|---|---|
| Application support for technology tool skill development | Count of applications, by type, in use in instructional settings in the school or district that support technology tool skill development. |

TERM CATEGORIES

**Examples of application types that support technology tool skill development in instructional settings**: word processors; spreadsheets; database software; desktop publishing; process writing software; keyboarding training software; telecommunications; web browsers and search engines; web authoring; presentation development software; programming tools, including compilers and interpreters.

As applications and devices in use in classrooms continue to evolve, and as technology becomes further integrated into education, what are considered "basic tool skills" can be expected to evolve. Five years from now, the above list will be quite different from what it is now, even if it is not much longer.

### *Key Question 3. Does the school/district use technology applications to improve communication?*

There are a number of important communication functions that schools and districts carry out which technology can enable or improve. Communication between school staff and parents of students can be supported through class homework assignment web pages or telephone hotlines. E-mail can support direct parent communication with teachers or the principal. Communication with the larger community is enabled by school web pages or online school "report cards"; the latter often become part of real estate agencies' electronic brochures for the community.

Schools use computer-based networks to conduct significant business with their districts, other institutions, and with state authorities. Data are sent to state education agencies; requests for purchases go back and forth from schools to central districts. Staff attendance records are forwarded to district payroll systems. Transcripts are sent to other schools or districts when students move, or to colleges when students graduate.

The current list of indicators below focuses on electronic mail and web use. Indicators related to telephone use could also be developed.

INDICATORS *(for term definitions and categories, see below)*

| | |
|---|---|
| Applications for communication | E-mail type: School or district-wide, non-Internet; Internet-based; none. |
| | E-mail: Percentage of teachers with active accounts. |
| | E-mail: Percentage of students with active accounts. |
| | Existence of active district/school web site. |
| | School web site usage. |
| | Percentage of classrooms with active web pages. |
| | Percentage of teachers with active web pages. |
| | Use of Internet telephony ("voice over IP," or voIP) in the school or district. |

TERM DEFINITIONS AND CATEGORIES

**Active account** (electronic mail): At least one message sent in the current academic year.

**Active web site/page**: At least one update in the past 90 days.

**School/district web site usage**: Count of user sessions in a month, converted to a daily average.

## *Key Question 4. Does the school/district have appropriate software and systems to support primary administrative functions?*

Although most of the public and policy focus on computing in schools addresses instructional uses, large gains in efficiency and effectiveness in schools can be made by using computers and network systems in administrative applications. Although such applications are decidedly less glamorous and less likely to be visible or appear reasonable to anxious parents worried about their children's future, they can play a critical role in making food services, transportation or records management work better and in reducing the management burden on senior administrators so they can maintain their focus on students' education.

Administrative software is also essential to the gathering, processing, and transmission of critical education data. Applications at the district level can be integrated into decision support tools.

Strategic partnerships between schools and private corporations have resulted in technology forums, initiatives, and criteria to assist superintendents in choosing models to follow.

### "One School's Way"

Raymond Yeagley explains his district's experience in choosing software applications in this excerpt from "Data in Your Hands," in *The School Administrator*, April 2001. Yeagley is superintendent of the Rochester School Department in Rochester, New Hampshire.

Administrative software packages used by most schools store student profiles, grades, attendance and discipline records. Testing companies can provide electronic versions of their scoring reports that include student-specific information. Additionally, scanners permit districts to automate tabulation of surveys and other local data collections. Availability and compatibility of data are no longer a barrier.

*A greater challenge than collecting data is creating a process to transform the data into easily accessible, useful information that staff members will employ for school improvement. Building on a goal-setting and accountability process already in place in our district, we identified four principles to guide our efforts in Rochester* (emphasis added):

- Instructional change is the first priority. Data will be used to identify district, school and

INDICATORS *(for term descriptions and categories, see below)*

| | |
|---|---|
| Applications for core administrative activities | Availability of applications to support core administrative activities, by activity type. |
| Applications for decision support | Decision support tools are available to administrators. |
| | Decision support tools are available to teachers and curriculum groups. |
| | Decision support tools are available to parents and the public. |
| | Availability of decision support tools, by information category. |
| Applications for policy support | Availability of applications that support school/district Security and Acceptable Use Policies. |
| | Applications in regular use that support the school/district Security and Acceptable Use Policies, by application type. |

TERM DESCRIPTIONS AND CATEGORIES

**Software/application types to support core administrative activities**: Capital improvements (building and grounds); financial (accounting, budgeting, payroll, human resources); food services; inventory control; library services (cataloguing, circulation); network security (firewall, filtering, secure data transmission, Acceptable Use Policy enforcement); office applications; student materials (purchasing, inventory); student records management (attendance, assessment, grading); teacher records management (attendance, assessment, certification); transportation; other software and applications.

## *Key Question 5. Are the applications in use evaluated for effectiveness?*

Standards for educational technology applications are being developed, with the potential to be used for assessment of instructional software and applications. There are already many databases available that offer thousands of reviews of educational technology, including instructional software (see the Resources section at the end of this chapter). Technical coordinators and other evaluators will have to develop criteria to evaluate the effectiveness of products beyond "best-of-breed" determinations.

The situation is more problematic for evaluation of administrative software and applications. Standards for such applications do not exist or at least represent an entirely different framework. Schools and districts need to evaluate administrative software in terms of functional effectiveness (i.e., do they accomplish the goals they are intended to accomplish?). Review databases may be helpful in this context.

INDICATORS

| | |
|---|---|
| Software evaluation | Existence of software evaluation plan. |
| | Evaluation ratings by software category. |

School districts have evaluation procedures in place that may include reviewing the content of software and web sites for alignment with state or local learning standards (see the sidebar "Evaluating Web-Based Products and Standards" on the next page), accuracy, grade and ability levels, special student needs, teacher training requirements, and more. Others take advantage of services such as EvaluTech (**http://www.evalutech.sreb.org**) or states such as Florida (**http://www.doe.firn.edu/edtech/it/esc.shtml**) and California (**http://www.clrn.org/home/**), which have developed extensive evaluation web sites to assist educators in selecting high-quality electronic learning resources.

## Unit Record Structure

Although information about technology applications is typically analyzed at the school or district level, the relevant unit for data element definitions is the software program or application. Unit records for software form the basic elements for a comprehensive technology application database.

A system based on unit records would meet day-to-day administrative needs and support overall assessment and planning. As noted in other chapters, these suggested records are not intended to define data collection. Instead, they illustrate basic units of a data system from which data elements and indicators can be extracted to answer important policy and planning questions.

The data elements listed below, along with others defining basic school components such as classrooms and adapted from other NCES handbooks, can be used to create the indicators listed in this chapter. The complete list of data elements for this guide can be found in Appendix A; a number of detailed examples illustrating the creation of indicators from data elements can be found in Appendix B.

LIST OF POTENTIAL DATA ELEMENTS FOR A UNIT RECORD: SAMPLE UNIT RECORD FOR ALL SOFTWARE AND APPLICATIONS OFFICIALLY INSTALLED IN SCHOOL SYSTEM EQUIPMENT

**For each software or application listing**:

**General information**:

Title and ID code
Name of creator company
Name of vendor

classroom strengths and weaknesses, then find ways to reinforce the strengths and address the weaknesses to improve student learning.

- Staff training is essential for effective data use. Staff members must understand not only how to interpret the information accurately, but also how to identify, adapt and apply more effective instructional strategies based on their analysis.
- Communicating results is a vital component. Communicating a complete, accurate and understandable picture of our district's performance to all of our constituents will improve community support and encourage school effectiveness.
- Inviting feedback closes the loop. Obtaining feedback from constituents is as important in assessing district and school progress as measuring student achievement. In addition to the traditional performance indicators, the district can benefit from obtaining and analyzing data on community satisfaction and all other aspects of operation.

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Vendor address
Vendor contact number
Installed version number
Latest version available
Number of licenses purchased **or** maximum number of concurrent users
Date of license expiration/renewal
Date purchased
Date technical support expires
Technical support entity
Technical support entity address
Technical support contact number
Evaluation rating

**For instructional and instructional support software:**

**Descriptive information about educational function, if applicable**:

Specific curriculum area(s) [list areas]
Specific grade level(s) [list levels]
Alignment with standards: alignment rating
Instructional application type, if applicable
Tool skill development category, if applicable
Teacher-support instructional application type, if applicable

**For administrative software**:

Administrative activity category

**For each machine or workstation**:

Software/application title(s) and ID
Date installed
Date of most recent upgrade
History of use and problems

Records kept and aggregated at building or district level.

[There also exists a database of all instructional machines in use (see unit records for Chapter 3), in which there will be a record of all software and applications installed.]

### "Evaluating Web-Based Products and Standards"

The American Association of School Administrators (AASA) has formed a Standards Development Board to address a broad range of areas in which consumers, in this case, educators, can judge web-based products and services. Here are eight areas of consideration in their *Standards for Web-Based Education Products and Services, Guidelines for K–12 Educators:*

- Content Quality
- Correlation to Standards
- Educational Support
- Effectiveness
- Equity
- Privacy/Safety
- Technology Support
- User Friendliness

(For a complete description of these standards, please see ***http://www.aasa.org/issues_andinsights/technology/Ed.com_brochure.pdf***)

## Resources

American Association of School Administrators. (2001). *Standards for Web-Based Education Products and Services, Guidelines for K–12 Educators.* See ***http://www.aasa.org/issues_and_insights/technology/Ed.com_brochure.pdf***

Association for Supervision and Curriculum Development. (2001). "Teachers and Technology," *Curriculum Update.* See archives at ***http://www.ascd.org/readingroom/cupdate/2001/framefall01cu.html***

*Education Week*. (1999). "Is the Software Right for You?" *Special Report: Technology Counts.*
See **http://www.edweek.org/sreports/tc99/articles/screening-s1.htm**

Yeagley, R. (April 2001). "Data in Your Hands," *The School Administrator.* American Association of School Administrators.
See **http://www.aasa.org/publications/sa/2001_04/yeagley.htm**

### *For evaluation*

Cambridge Development Lab's educational software curriculum matching program.
See **http://www.edumatch.com/**

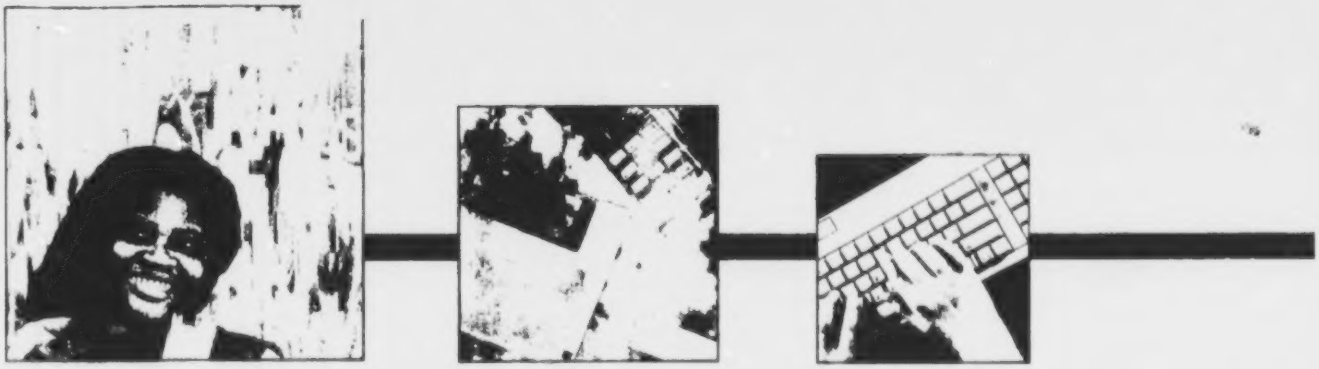
EvaluTech's searchable database contains more than 7,000 reviews of instructional materials recommended for classroom use in kindergarten through grade 12.
See **http://www.evalutech.sreb.org**

The Florida Department of Education's Bureau of Educational Technology surveys every school and district office for nominations of up to 10 software titles every year.
See **http://www.doe.firn.edu/edtech/it/esc.shtml**

The California Learning Resource Network provides supplemental electronic learning resources that both meet local instructional needs and embody the implementation of California curriculum frameworks and standards. See **http://www.clrn.org/home/**

### *Other in-depth resources*

The Schools Interoperability Framework (SIF) is an industry initiative to develop an open specification for ensuring that K–12 instructional and administrative software applications work together more effectively. SIF is not a product, but rather an industry-supported technical blueprint for K–12 software that will enable diverse applications to interact and share data seamlessly, now and in the future.
See **http://www.sifinfo.org/**



*"With the introduction of new hardware and increased demands on support staff comes the vital question: How will this help us teach? Inevitably, this question is asked first not of the teachers themselves, but of technologists."*

**Richard M. Beattie**, director of technology, Brunswick School, Greenwich, Conn., in "The Truth About Tech Support," from the September 2000 issue of *Electronic School*

# Chapter 5

## Maintenance and Support

### What to Expect From This Chapter

- Resources and ideas for establishing a support system and tracking maintenance incidents and support calls
- Suggestions for ensuring quality technical support and thorough maintenance
- Understanding the need to include maintenance and support in new technology purchases, including personnel resources

BEST COPY AVAILABLE

**The story of Jane Neussup continues...**

***Maintenance and Support***

Stopping first at the help desk, John asks Deb the tech what the problem is.

Deb answers,"Well, John, the server has a network interface problem.I'm bringing the network up again, but I checked our logs and found that this is the fourth time this problem has occurred this month. Since we're paying so much for maintenance on that server, we've contacted the vendor to request a replacement under our service contract."

Then she adds,"By the way, John, Dr. Neussup's secretary is anxious to see you. She's struggling with a survey on hardware and software use in our district."

John says,"I've already seen her and answered her questions. Now I've got to go and see the high school Science Department folks."

[To be continued...]

# Key Questions for This Chapter

1. Are resources and processes in place to maintain school technology?
2. Are personnel available to provide technical support?

# Overview

Installed technology needs ongoing maintenance and support, or it will not remain functional for long. As technology has become embedded in the school setting, schools and districts have had to come up with systems to support it, and have had to create support roles and find people to fill them. This chapter provides rules and guidelines for assessing the systems that support technology use.

It is a challenge to assess the status of maintenance and support mechanisms and people because the alternatives are so varied. In the early stages of implementation of technology in schools, the need for maintenance is often unanticipated. Volunteers are pressed into service, or teachers with an interest in technology are assigned support roles in addition to their other obligations. Such systems and roles are difficult to sustain. It is a hallmark of the institutionalization of technology that more formal systems for maintenance and support have been established.

Current trends in support for technology systems include the establishment of more formal technology support structures, often using helpdesk software to track requests for support and responses; at the other extreme of the spectrum, trends include the incorporation of students in middle and secondary school as sources of technical help and outsourcing to nonschool persons or entities, either on a volunteer or more formal contract basis. It is worth emphasizing that in the latter situation, as with any situation in which work products depend on persons not under the control of the organization, proper documentation is an essential requirement and should be made an explicit part of any outsourcing contract or agreement.

Much of the information that a school or district needs to assess the status of maintenance and support systems can be extracted from a database on inventory and maintenance of hardware and software. Indicators are provided below for measuring both maintenance and support of technology resources in school administrative and instructional settings and for assessing the roles of personnel providing that support to teachers, students, and administrative staff.

# Defining Maintenance and Support

**Maintenance** in this chapter means those preventive, diagnostic, updating, replacement, and repair procedures that a school or district has in place. Maintenance can be provided either by persons who are part of the school system or through an outsourced contract. It includes documenting trends and patterns in the use of applications or equipment. Specific maintenance items might include:

- periodic replacement of parts and renewal of consumable supplies;
- repair or replacement of faulty components;
- periodic inspection and cleaning of equipment;
- updating or upgrading hardware and software, including installing new operating system versions;
- adding or deleting users from a system, or modifying user rights and properties;
- periodic backup of stored files on a school network;
- monitoring the condition and functionality of networks and equipment, including testing web site accesses and links; and
- installing and removing equipment and applications.

The term **support** refers to actions taken on behalf of users rather than to actions taken on equipment and systems. Support denotes activities that keep users working or help users improve the ways they work. (Readers should note that professional development and training are explicitly excepted; they are discussed in the following chapter.) Included under support might be such items as:

- help desks and other forms of putting a person in touch with another person to resolve a problem or provide advice;
- automated information systems, such as searchable frequently-asked-question (FAQ) databases or newsletters;
- initial training and familiarization tours for equipment and software, whether automated or conducted by a human;
- instructional and curriculum integration support, usually through observation and personal interaction between a teacher and a technology coordinator; and
- technology integration support for administrative applications, usually conducted through specialized consultants or software/systems vendors.

**"Usage Tip"**

Answering the key questions in this chapter can provide the following information:

- average number of yearly maintenance incidents by workstation, building, or district;
- average number of yearly incidents per full-time-equivalent (FTE) technical support staff hours;
- total hours of downtime per year by workstation, classroom, building, or district;
- number of incidents per year by type or category; and
- ratio of tech support staff to number of computers, total staff, number of buildings, etc.

As with maintenance, support can be delivered through a variety of mechanisms, including in-house technology specialists, external volunteers, or outsourced contracts.

Indicators in this chapter address the procedures, response times, support sources, and workloads related to maintenance and support.

## Key Questions and Indicators

The key questions of this chapter are divided between procedures and personnel, although these issues are as related as two sides to one coin. While support rules of thumb have been recognized for business settings, schools still operate on a comparative shoestring. Recommendations for support levels do exist (see the sidebar, "Four Ways to Ensure Quality Tech Support in Schools," on page 58).

### *Key Question 1. Are resources and processes in place to maintain school technology?*

Technology has not yet fully established itself in the school setting, as it has in many business sectors. When the network goes down in a school or district, the administrators, teachers, and students just wait until it comes back up. Any information lost may not be restored. In the instructional setting, preparing for an outage may mean that teachers file printouts as backup materials. The same outage in the business world can cost hundreds of thousands of dollars in lost sales; lost instructional time has not been valued in the same way. Yet, as schools rely more and more on the use of technology (both administratively and instructionally), the loss of time and information is increasingly understood to be expensive and disruptive to the learning process. Maintenance and backup systems are therefore begining to be recognized as important throughout the school setting.

This key question assesses maintenance and support systems in terms of the number of maintenance incidents, the amount of downtime, and the stages of response to a request for maintenance; provisions for preventive maintenance; access to FAQ resources and technical manuals; backup and disaster recovery procedures; replacement and upgrade procedures; and diagnostic and repair procedures.

INDICATORS *(for term definitions and categories, see above)*

| | |
|---|---|
| Reliability of equipment and infrastructure | Number of maintenance incidents for current academic year per workstation/server; cause category, location. |
| | Average number of hours of downtime for current academic year (per workstation/server, etc.). |
| | Average number of calls to help desk/ tech-support services, per workstation/server. |
| | Average time elapsed between initial call to help desk and response call to end user. |
| | Average time between initial response call and notification of problem resolution. |
| Preventive maintenance procedures | Preventive maintenance schedule established. |
| | Preventive maintenance checklist provided for enduser. |
| | FAQ access provided (to tech support; to end users). |
| | Access to technical manuals provided for end users. |
| | Backup procedures in place. |
| | Disaster recovery procedures in place. |
| Update and replacement procedures | Replacement/upgrade schedule established for hardware. |
| | Replacement/upgrade schedule established for software. |
| Diagnostic and repair resources | Help desk support software available (trouble ticketing, resolution tracking). |
| | Diagnostic software available (where appropriate). |
| | Appropriate repair instruments/tools available on school premises. |
| | Basic replacement parts in stock. |

## TERM DEFINITIONS AND CATEGORIES

**Cause of maintenance incident, categories**: human error; software failure; hardware failure; network switching device or router failure; network cable or wiring failure; wireless system failure.

**Downtime**: the amount of time a machine or system spends in an inoperable state; alternatively, the amount of time between a call for maintenance and the resolution of the problem.

**Technical manual location categories**: at workstation; in classroom or laboratory; in library or other building central location; at district office or technology support office; online through local resources; online through vendor or other remote resource.

## *Key Question 2. Are personnel available to provide technical support?*

As schools commit more funds to the purchase of technology, they must also look at the support needed by the end users of these purchases. Most school systems have designated an office of technology support, but rarely do tech support personnel work directly with school staff. Usually, the only times tech support visits a school is when there is a major infrastructure malfunction or new equipment is being installed. Even more rarely can central-office technology support personnel be of assistance in educating users, say, on how a software package works.

The majority of support personnel time is focused on acquiring, installing, and maintaining hardware and the technology infrastructure. The ratio of end users (or computers) to professional support personnel is generally very high (see the sidebars on this page and on page 60). As schools record the levels of support staffing and maintenance incidents, they can work to determine acceptable support ratios.

Much support for instructional staff comes from volunteer or part-time technology coordinators, working on donated time or in addition to other instructional obligations. Help desks are still a relative rarity. Use of students in these roles is not uncommon.

Indicators for this key question assess numbers of support personnel and full-time-equivalent (FTE) hours, the extent to which support personnel have other responsibilities within the school system, the total number of person-hours of technical support committed, and various ratios—of support calls to FTE staff hours, of support staff to the number of computers, and of support staff to the number of users.

**"Four Ways to Ensure Quality Tech Support in Schools," by Richard M. Beattie**

As school technology systems get more complex, schools must further professionalize their technical support departments. No longer can schools rely on members of their academic departments who have an interest in technology to perform major system upgrades, maintenance, and troubleshooting. Anecdotal evidence shows a rising level of burnout on the part of those educators who have added the informal title of "computer expert" to their list of responsibilities within schools.

Unfortunately, schools have a long way to go. As a point of comparison, large companies strive to have at least one professional computer support person for every 50 computers (laptops or PCs) in use. Few, if any, schools enjoy a ratio this low. With the many other demands for hiring in most school systems, it's no surprise that administrators cannot focus on improving tech support departments—especially if this would come at the expense of hiring teachers to provide additional educational options or reduce class sizes.

INDICATORS *(for term definitions and categories, see next page)*

| | |
|---|---|
| Technical support staffing | Number of dedicated persons assigned to technical support (at building, district levels). |
| | Percent of FTE hours assigned to technical support (including dedicated positions) (at building, district levels). |
| | Percent of FTE hours assigned to technical support, by primary area of responsibility. |
| Source of technical support | Average hours of technical support at the building level by source. |
| | Average hours of technical support at the district level by source. |
| Technical support workload | Number of calls handled by FTE position, and by dedicated positions. |
| | Ratio of calls or incidents to FTE support staff hours. |
| | Ratio of technical support staff to numbers of workstations/ servers. |
| | Ratio of technical support staff to end users. |

TERM DEFINITIONS AND CATEGORIES

**Full-time-equivalent (FTE) support staff hours**: Total number of hours committed by support staff (equals the sum of FTE levels for each support staff person).

**Primary area of responsibility, categories**: Part-time teacher; full-time teacher; part-time administrator; full-time administrator; student; outsource contractor; volunteer; school staff technology support specialist; district staff technology support specialist.

Many of the above indicators might be derived from their inclusion in the support portion of a school's technology plan, which clearly should extend from the classroom to the central office. Some possible components of this plan could be district help desks, a workable staffing ratio of support personnel to end users or computers, and the degree of outsourcing for technology support. The implementation of these plan components could lead to the development of other indicators for this key question.

Nevertheless, for technology to reach its potential in K–12 education, technology experts—not just technophiles—must be intimately involved in using a school's precious technology dollars to match the school's mission and serve its unique student body.

Achieving these goals starts with a firm commitment to quality in technical staff. This can be achieved in four ways, according to the author:

1. Administrators should recognize that technology experts must be able to focus on their roles full time.
2. These individuals must have an understanding of the educational process, as well as computer technology.
3. Schools and districts must budget realistically not only to purchase technology, but also to maintain and upgrade it on a regular basis so that it can be used by students and teachers.
4. Tech staff must be committed to making themselves key members of the school's planning process, not just crisis managers who keep the machines running.

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## Unit Record Structure

As stated , almost all of the data for the indicators listed above can be derived from the support portion of a school's technology plan. Other sources of information could be the school district's maintenance system for technology equipment, an incident tracking system (which may be computerized), or maintenance agreements with outside vendors.

The identifiable units for recording purposes related to maintenance support are each incident, each technical support staff person, and each piece of equipment requiring repair.

The data elements listed below can be used to create the indicators listed in this chapter. The complete list of data elements for this guide can be found in Appendix A; a number of detailed examples illustrating the creation of indicators from data elements can be found in Appendix B.

LIST OF POTENTIAL DATA ELEMENTS FOR A UNIT RECORD: SAMPLE UNIT RECORD FOR INCIDENT DATA

**For each incident:**

Incident demographics

- Incident control ID—a unique number identifier for the call
- School ID—a unique number identifier for the school
- Equipment ID—this will supply information as to type variables, cost/financial variables, use variables, and warranty information
- Software ID
- Incident date—the date the incident was called in
- Incident time—the time the incident was first called in
- Initial incident cause category—the initial indication as to the cause (human, software, hardware, network [router/switch, wiring])
- Symptoms—a description of what was/is happening with the equipment

Incident resolution

- Date picked up—the date the equipment was transported to the repair facility
- Trip #—the unique ID number for the actual pickup/delivery
- Status—current information concerning state of repair (categories: waiting; in repair; holding for parts; completed; returned to owner)
- Repairs made—a description of what was done to resolve the problem
- Repair date—the date the equipment was repaired
- Parts used
- Parts cost
- Labor hours—number of hours needed to resolve the problem, including pickup and delivery
- Incident cause (categories: human error; software failure; hardware failure; network switching device or router failure; network cable or wiring failure; wireless system failure)
- How repaired (at service location, picked up by staff, at service location, brought in by user; if software, by download, through telephone guidance to user by service staff)

- Location of repair (at school, at district central office, at contractor location, at vendor location)
- Date returned—the date the equipment was transported the point of pickup
- Time and date stamp for when record was last modified
- Incident resolution provider ID(s)
- Hours spent on incident

**For each support person:**

- Name
- Provider ID
- Location of provider (school building, central district office, outside location)
- Primary role: part-time teacher, full-time teacher, part-time administrator, full-time administrator, student, outsource contractor, volunteer, school-level tech support specialist, district-level tech support specialist (school system employee)
- FTE hours assigned to tech support
- Hours per month spent on different activities: repair of equipment; wiring/cabling; training of school personnel (other than technology support); training of technology support staff; help desk calls; network administration; initial installation of hardware; initial installation of software; hardware upgrades; software upgrades; technology support management (planning, budgeting/purchasing, etc.)

Records kept and aggregated at workstation, building, or district level.

### "Tech Support Rule-of-Thumb"

Keep in mind that the corporate standard is to have one support personnel for every 50 laptops or PCs. In schools that distribute computers to every student, that means 400 students and faculty members would require a technology staff of eight—hardly the norm.

## Resources

Beattie, R.M. (Sept. 2000). "The Truth About Tech Support," *Electronic School.* See **http://www.electronic-school.com/2000/09/0900f3.html**

"Critical Issue: Promoting Technology Use in Schools," *Pathways to School Improvement*, North Central Regional Educational Laboratory. See **http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te200.htm**

Fitzgerald, S. (2001). "Five Measures of a Tech-Savvy School District," abstracted from "Taking the 'Total Cost of Ownership' Concept to the Classroom." *MultiMedia Schools.* See **http://www.eschoolnews.org/news/showStory.cfm?ArticleID=2791**

Merit Network and Western Michigan University. "Michigan Technology Staffing Guidelines." This is an ongoing project; the web site provides documentation on roles and responsibilities for support staff, and includes staffing level estimates. See **http://techguide.merit.edu/**

Murray, B. (2001). "Tech Support: More for Less." *Technology & Learning Magazine.* See **http://www.techlearning.com/db_area/archives/TL/200111/whatworks.html**

Robinson, T. (1999). "eSN Special Report: Serving up Support," *eSchool News.* See **http://www.eschoolnews.org/news/showStory.cfm?ArticleID=556**

Shaw, T. (2001). "How to set realistic tech-support staffing goals," *eSchool News*. See **http://www.eschoolnews.org/news/showStory.cfm?ArticleID=2108**

"The Ultimate Preventative Maintenance Checklist." (1999). *TechRepublic* (downloadable file; users will be asked to register for free membership). See ***http://www.techrepublic.com/download_item.jhtml?id=dw03119990818jed01.htm***

*"...When professional development is redefined as a central part of teaching, most decisions and plans related to embedding professional development in the daily work life of teachers will be made at the local school level. Some reformers have recommended that at least 20 percent of teachers' work time should be given to professional study and collaborative work....The National Education Association...recommends that 50 percent of teachers' time be given to professional development."*

**North Central Regional Educational Laboratory,** from "Critical Issue: Finding Time for Professional Development," *Pathways to School Improvement*, 1997

# Chapter 6

## Professional Development

### What to Expect From This Chapter

- Resources and ideas for evaluating professional development programs
- Suggestions for tracking training needs
- Ideas to improve professional development in schools
- What to look for in professional development programs
- How to evaluate professional development in general

**The story of Jane Neussup continues...**

***Staff Development***

On the way back to his office, John runs into Nell Person, director of personnel, and decides to ask Nell about staff development for teachers in technology use.

Nell replies, "I can give you a three-year summary of the district's technology training goal as outlined in the technology plan as soon as the network comes back up."

John says, "The network will be up again momentarily—I just saw Deb and she's working on it. It's a pesky problem, but we should have it solved soon. But I wanted to ask: How many of the high school science teachers have taken the professional development workshops in technology?"

Nell promises to let him know, if the data are not in the technology plan report. John rushes off to his next meeting, with the science teachers.

[To be continued...]

## Key Questions for This Chapter

1. What technology-related training and/or professional development do staff receive?
2. What are the goals, methods, incentives, and content of technology-related training and/or professional development for staff?
3. How are training and/or professional development for staff evaluated?

## Overview

Using technology in the school setting requires training (to develop the knowledge and skills to apply the tools) and professional development (to understand and apply the technology in instruction and school management).

Ideally, technological tools should be a seamless part of the school environment, requiring no more prior learning to apply than, say, electricity. Teachers and students would use technological tools—or not—in learning situations, depending on whether they helped one to learn in that context. If research were required, students would conduct it at the school digital library or at a remote resource as needed. School administrative records and cafeteria food requirements would be updated automatically from entry-screening systems, or perhaps the attendance software on a teacher's personal digital assistant (PDA).

But the technological tools available do not fit together this seamlessly yet, and teachers and staff (and students) need training and professional development in order to make the best use of technology in schools. In fact, providing sufficient development and training to give staff skills and confidence in the use of technology is widely viewed as an ongoing challenge to schools. Calls have repeatedly been made to increase funding for professional development; the recently reauthorized Elementary and Secondary Education Act (ESEA, the "No Child Left Behind Act of 2001," Public Law 107-110) has included in its support for technology the requirement that 25 percent of the funds be devoted to training and professional development.

It is for this reason that assessing the status of training and professional development delivery is important: users of this handbook know that it is critical and that not enough may be reaching the persons who need it. Technology use also has to be taught in the context of educational or management activities, which means that measuring the extent of "pure" technology preparation is very difficult.

In the remainder of this chapter, the term **professional development** will be used to stand for both training and professional development. Although the handbook authors recognize the differences between these terms, it is awkward to keep referring to both concepts separately when, for purposes of assessment, they are dealt with together.

## Defining Professional Development

This guide uses the term **professional development** to represent learning activities of all kinds for school staff that prepare them to use technology in the school setting. Included under the term are activities such as the following:

- familiarization with the operation of equipment and software;
- development of proficiency in the use of the technology "tools" to carry out school tasks;
- the application of software and applications to the management of school activities, whether instructional or administrative; and
- the integration of technology into teaching, learning, and administrative processes.

Professional development, for the purposes of this chapter, is explicitly understood to extend to administrative and support staff whose jobs have changed and will continue to change due to the infusion of technology in schools. Professional development includes support for teachers and staff as they apply technology to their evolving practices, from lesson plans and curriculum integration to recordkeeping and administrative functions. It is an ongoing process that cannot be satisfied with one-time training in a particular technology.

Indicators for assessing teacher and administrative use of technology and proficiency levels are given in Chapter 7, Technology Integration; indicators for technology support are found in Chapter 5, Maintenance and Support.

## Key Questions and Indicators

The three key questions and their indicators below deal with, in order, how much technology-related training is provided to staff, what that training consists of, including its methods and goals, and lastly, if and how such training is evaluated.

In Chapter 7, the assessment of technology proficiency is discussed, and, in that context, a series of standards for teacher preparation in technology literacy are referenced. These standards, and others adopted by states (see, for example, the Virginia standards for technology also cited in Chapter 7), provide a basis for designing professional development opportunities for teachers. Similar benchmarks are available for school administrators (again, see the Technology Standards for School Administrators reference in Chapter 7), although not for administrative support staff.

## Key Question 1. What technology-related training and/or professional development do staff receive?

This key question and its indicators relate to tracking hours and participation percentages for recordkeeping purposes.

In addition to the above-mentioned standards, there are guidelines available to technology planners and administrators, providing ideas on what professional development for technology use should encompass. Broad categories, such as those in "Critical Issue: Providing Professional Development for Effective Technology Use," developed by the North Central Regional Educational Laboratory (NCREL), can be helpful in planning what types of courses to include. The NCREL report lists the following desirable elements: a connection to student learning; hands-on technology use; variety in learning experiences; curriculum-specific applications; new roles for teachers; collegial approaches to learning; active participation of teachers; ongoing process; sufficient time; technical assistance and support; administrative support; adequate resources; continuous funding; and built-in evaluation. (See Resources for further detail.)

The Michigan State Department of Education has also developed standards for professional development with indicators divided into categories of context, process, and content that may prove helpful in assessing technology-related staff training. (See the sidebar on these pages.)

INDICATORS *(for term definitions and categories, see page 68)*

| | |
|---|---|
| Technology-related training and/or professional development for instructional staff | Total hours of professional development received by instructional staff in the most recent academic year, per instructional staff FTE. |
| | Hours of technology-related professional development received by instructional staff in the most recent academic year, per instructional staff FTE. |
| | Percentage of hours of technology-related professional development to total hours of professional development received by instructional staff. |
| | Percentage of instructional staff with at least the minimum district or state-required hours of technology-related professional development in the most recent academic year. |

**"Standards for Professional Development," from the Michigan State Department of Education**

***Standards for the Process of Professional Development***

Quality professional development, structured and provided within a context of ongoing school improvement planning and a culture of collaboration, improves and sustains the capacity of the adult learner to:

**Standard 1: use inquiry and reflective practice within the learning community.**

Sample Indicator: educators keep journals to record and reflect on their own practice; time is allocated at school improvement and staff meetings to share journal content and to review curriculum, instruction, and assessment techniques, and process exists to make appropriate changes.

**Standard 2: learn from recognized resources within both the public and private sectors, from successful models, and from colleagues and others in the learning community.**

Sample Indicator: time is invested to study the research on teaching and learning, to learn from presentations, to learn from recognized resources in the private sector and government, and to learn from collegial exchange.

**Standard 3: identify personal and adult learning needs and styles, and select appropriate modes of participation.**

Sample Indicator: educators have the opportunity to complete learning style inventories and to

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INDICATORS *(continued)*

| | |
|---|---|
| Technology-related training and/or professional development for administrative and support staff | Hours of professional development received by administrative and support staff in the most recent academic year, per administrative and support staff FTE. |
| | Hours of technology-related professional development received by administrative and support staff in the most recent academic year, per administrative and support staff FTE. |
| | Estimated percentage of hours of technology-related professional development of total hours of professional development received by administrative and support staff. |
| | Percentage of administrative and support staff with at least the minimum district or state-required hours of technology-related professional development received in the most recent academic year. |

## *Key Question 2. What are the goals, methods, incentives, and content of technology-related training and/or professional development for staff?*

The methods and content of technology-related professional development are changing as quickly as technology itself. Still, guidelines exist for goals in the form of technological proficiency levels found in standards such as ISTE's NETS for Teachers and the Technology Standards for School Administrators (see Chapter 7 Resources). A goal statement should also be set forth in the professional development portion of a district's technology plan.

Technology has brought a windfall for delivery methods in professional development. Online delivery means can help educators to find the best time for training based on their own schedules (see the Resources for this chapter). Video and audio conferencing allow teachers access to both instructional and collegial support. E-mail and e-bulletin boards enable teachers to share information and solve problems. Still, taken as a whole, technology cannot solve the problem of allocating the time needed for ongoing professional development to establish and maintain proficiency in technology use. There are many competing demands for teachers' and administrators' time, and districts need to allocate sufficient time and resources for professional development and training (of all kinds).

select professional development compatible with individual learning styles.

**Standard 4: implement research-based leadership strategies to support and sustain ongoing developmental activities.**

Sample Indicator: time and opportunities are provided for mentoring, peer coaching, study groups and action research among educators and all those impacting student learning.

**Standard 5: integrate technologies as tools to assist with the curriculum development, instructional management, and assessment practices.**

Sample Indicator: time and training are provided for educators to use and adapt technological systems to the learning needs of adults and students.

**Standard 6: invest time in an ongoing process of collegial dialogue, collaborative learning, and exploration of new and/or proven instructional strategies.**

Sample Indicator: time is invested for focused collegial dialogue at school improvement and staff meetings. Research based materials and best practice information are exchanged and discussed. Data specific to student academic achievement are shared and utilized to inform modifications to curriculum, instruction, and assessment practices.

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INDICATORS *(for term definitions and categories, see below)*

| | |
|---|---|
| Goals and content of technology-related professional development for instructional staff | Existence of a written goal statement for technology-related training/professional development for instructional staff. |
| | Technology-related content areas covered in training and/or professional development for instructional staff in the past academic year. (See term definitions and categories below.) |
| Methods and incentives of technology-related professional development for instructional staff | Delivery means used for technology-related training and/or professional development for instructional staff. |
| | Percentage of total hours of technology-related professional development provided to instructional staff through various means. |
| | Incentives provided for technology-related professional development to instructional staff. |
| Goals and content of technology-related professional development for administrative and support staff | Is there a written goal statement for technology-related professional development for administrative and support staff? |
| | Technology-related content areas covered in professional development for administrative and support staff in the past academic year. (See term definitions and categories below.) |
| Methods and incentives of technology-related professional development for administrative and support staff | Delivery means for technology-related professional development for administrative and support staff. |
| | Percentage of total hours of technology-related professional development provided to administrative and support staff through various means. |
| | Incentives provided for technology-related professional development to administrative and support staff. |

## TERM DEFINITIONS AND CATEGORIES

**Academic year**: A period that begins on the first day of classes and ends on the last day of classes, usually consisting of two semesters or three quarters, and includes a minimum of 30 weeks of instructional time over the course of one calendar year.

**Delivery means**: Web or other online; interactive video or other teleconferencing; satellite or television broadcast; video tape, CD-ROM, DVD; "hands on" workshop; lecture, presentation, meeting; computer-based training. Indicate whether access setting is group or individual.

**Event type**: In-service staff development course offered during the normal workday; pre-service course for teachers or administrators; formal class offered outside of working hours.

**Incentives**: Recertification points or credits; salary points; money; certificate of class or course completion; provision of substitutes; release time; computer or training materials.

**Technology-related content areas**: Can include planning and designing technology-supported learning, implementing technology-supported learning, technology tool skills, professional productivity, assessment, social, ethical and legal issues.

### *Key Question 3. How are training and/or professional development for staff evaluated?*

Whether and how schools and districts assess professional development offerings is an important indication of the seriousness with which staff development is considered. Assessment must, however, go beyond a minimal "head count" approach, in which attendance lists or sign-in sheets are used as evidence of program success.

Tailoring evaluation methods to professional development programs makes sense—data on how teachers and administrators progress and how they are using new technologies to promote student achievement give great insight into what technology is doing for schools. By evaluating professional development, technology planners and administrators can learn what is working, and what or who needs help.

Measures of proficiency are discussed in Chapter 7 that could serve as outcome assessments, but such outcome measures are at best indirectly related to professional development inputs.

A list of assessment tools for professional development is provided in the Resources section at the end of this chapter. These are published by individual technology coordinators or planners and school systems; several are online.

INDICATORS *(for term definitions and categories, see above)*

| | |
|---|---|
| Training in evaluating instructional staff | Administrators, technology coordinators or curriculum supervisors/department heads receive training in evaluating instructional staff technology proficiency or extent of integration of technology into the curriculum. |
| | Existence of evaluation criteria for effects of training and/or professional development for instructional staff. |
| Training in evaluating administrative and support staff | Administrators or technology coordinators receive training in evaluating administrative and support staff technology proficiency. |
| | Existence of evaluation criteria for effects of training and/or professional development for administrative and support staff. |

## Unit Record Structure

The relevant unit for professional development data element definitions is the single training event or program. Single training event unit records form the basic elements for a comprehensive professional development database. A system based on training event unit records would meet day-to-day administrative needs and support overall assessment and planning. The data elements presented below illustrate basic units of a data system from which indicators can be derived to answer important policy and planning questions. It is important that training events cross-connect with teacher identification in these records, since many of the questions aggregate the professional development and training experiences of individual teachers.

The data elements listed below, along with others defining basic school components such as classrooms and adapted from other NCES handbooks, can be used to create the indicators listed in this chapter. The complete list of data elements for this guide can be found in Appendix A; a number of detailed examples illustrating the creation of indicators from data elements can be found in Appendix B.

### LIST OF POTENTIAL DATA ELEMENTS FOR A UNIT RECORD: STAFF TECHNOLOGY-RELATED TRAINING

**For each training/professional development event attended by at least one staff member at the school or district level, the following data elements are recorded:**

- Event starting date
- Event ending date
- Event name
- Total duration (seat time), hours
- Event type
- Mode of delivery
- Benchmarks, standards, or mandated curriculum areas (specified by state or district) covered in the course
- Contribution (number of hours) to minimum district or state-specified requirement
- Number of hours per academic year required by district or state
- Roster of participating staff (with individual identifiers if available; job classification)
- Event location: on school property; in district; away from district
- Proportion of time devoted to technology-related training and/or professional development (estimate by technology coordinator)
- Proportion of time devoted to technology-specific training and/or professional development (estimate by technology coordinator)
- Method of evaluation (none, exit test, proficiency certification)
- Result of evaluation (pass, score, fail)
- Form of credit (college credit [CEUs, CPD, credit hours])

# Resources

Bray, B. (1998). "Ten Steps to Effective Technology Staff Development."
See **http://www.compstrategies.com/staffdevelopment/tensteps.html**

"Critical Issue: Providing Professional Development for Effective Technology Use," *Pathways to School Improvement*, North Central Regional Educational Laboratory, 1997.
See **http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te1000.htm**

"Critical Issue: Finding Time for Professional Development," *Pathways to School Improvement*, North Central Regional Educational Laboratory, 1997.
See **http://www.ncrel.org/sdrs/areas/issues/educatrs/profdevl/pd300.htm**

Grant, C.M. (1996). "Professional Development in a Technological Age: New Definitions, Old Challenges, New Resources." *Technology Infusion and School Change*. TERC.
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McKenzie, J. (1998). "Secrets of Success: Professional Development That Works." *eSchool News*.
See **http://staffdevelop.org/secrets.html**

National Center for Research on Teacher Learning, Michigan State University, College of Education. *Learning to Walk the Reform Talk: A Framework for the Professional Development of Teachers*.
See **http://ncrtl.msu.edu/http/walk.pdf**

Nellen, T. (2001). "Assessing Staff Technology Needs: Do the Current Tools Work?" *Education World*.
See **http://www.education-world.com/a_admin/admin226.shtml**

## *Standards*

National Board for Professional Teaching Standards.
See (especially, Policy Position)
**http://www.nbpts.org/about/coreprops.cfm**

Standards for Staff Development, National Staff Development Council.
See **http://www.nsdc.org/list.htm**

## *Assessment tools*

Ted Nellen lists many tools for assessing staff for technology on his own web site.
See ***http://www.tnellen.com/school/assess.pdf***

Arizona State recently created an online Web assessment tool for all of their public school teachers.
See ***http://mycompass.asset.asu.edu/***

iAssessment.
See ***http://www.iassessment.com/***

Computer Strategies.
See ***http://www.compstrategies.com/staffdevelopment/index.html#ILP***

The Milken Family Foundation Professional Competency Continuum (PCC) Assessment Tool.
See ***http://www.mff.org/publications/publications.taf?page=280***

## *Other in-depth resources*

enGauge: Professional Development.
See ***http://www.ncrel.org/engauge/framewk/sys/dev/sysdevin.htm***

enGauge: Educator Proficiency.
See ***http://www.ncrel.org/engauge/framewk/pro/proin.htm***

Education Week Hot Topic: Professional Development.
See ***http://www.edweek.org/context/topics/issuespage.cfm?id=16***

The Milken Family Foundation Initiative on Education Technology.
See ***http://www.mff.org/edtech/***

"Building Bridges: Mission and Principles of Professional Development." The U.S. Department of Education's policy on professional development. Includes a chart on the "Principles of High-Quality Professional Development." Part of the Department's Goals 2000 area.
See ***http://www.ed.gov/G2K/bridge.html***

*"Leadership is the single most important factor affecting the successful integration of technology. This is true at the state level and at the school level. Schools which have made the most progress are those with energetic and committed leaders."*

From a 1998 study by the **SouthEast and Islands Regional Technology in Education Consortium**

# Chapter 7

## Technology Integration

### What to Expect From This Chapter

- Resources and ideas about measuring technology integration
- Suggestions for improving technology integration
- Awareness of technology readiness of staff
- Understanding the impact of technology on the school environment
- Understanding key players' roles in successfully integrating technology

**The story of Jane Neussup continues...**

***Integration***

John is meeting with the Science Department heads from each high school.

John repeats Dr. Neussup's question, "How is technology being used in science instruction?"

Anne Teeter, a science teacher for 20 years at Freshlook High, responds, "My class meets several of the state's learning standards in the area of meteorology by recording observations and entering the data into spreadsheets and analyzing it using formulas, charts, and graphs."

John asks the others, "How many of your teachers incorporate technology into their science lessons the way Ms. Teeter described?"

John determines that roughly 60 percent of the district's science teachers regularly incorporate the use of technology into their instruction. He then inquires about the 40 percent who are not incorporating technology, and learns that these teachers are not yet familiar with using technology in instruction. Obviously, there is work yet to be done in staff development.

[The story continues...though not in this handbook!]

## Key Questions for This Chapter

1. Are teachers proficient in the use of technology in the teaching/learning environment?
2. Are students proficient in the use of technology in the teaching/learning environment?
3. Are administrators and support staff proficient in the use of technology in support of school management?
4. Is technology integrated into the teaching/learning environment?
5. Are technology proficiencies and measures incorporated into teaching and learning standards?
6. Are technology proficiencies and measures incorporated into student assessment?
7. Is technology incorporated into administrative processes?
8. Is technology proficiency integrated into the evaluation of instructional and administrative staff?

## Overview

This chapter provides guidance, ideas and resources to assess the integration of technology into a school or district's instructional and management practices. Infusing a school with technology can be a transforming experience: the potential exists to change almost every aspect of school operations, and much of teaching and learning. Applications of technology in practice are examined through key questions, indicators, and measures for technology integration in the school setting.

There are a number of reasons to track the effectiveness of technology integration. The integration of technology into a school is in many ways like its integration into any business setting—technology is a tool to improve productivity and practice. Measures need to be available to assess effectiveness, and yet some of the most significant effects can be difficult to measure. For administrative tasks, technology can improve worker productivity by removing repetitive aspects of complex tasks or improving system communication. Technology integration in the classroom also has the potential to support important educational goals. Technology, it has been argued, helps change teacher-student relationships, encourages project-based learning styles, and supports the acquisition of skills such as "higher order thinking," analysis, and problem solving. The most important reason for measuring, though, is the understanding that the impact of technology on schools is dependent upon how successfully technology is integrated.

## Defining Technology Integration

**Technology integration** is the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods. This definition is not in itself sufficient to describe successful integration: it is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes.

**Integrating technology is what comes next after making the technology available and accessible. It is a goal-in-process, not an end state**. The goal of perfect technology integration is inherently unreachable: technologies change and develop, students and teachers come and go—things change. It is the process by which people and their institutional setting adapt to the technology that matters most. The process of technology integration is one of continuous change, learning, and (hopefully) improvement. Developing a culture that embraces technology is also important to its successful integration; for example, sending important messages by e-mail, or encouraging staff to use electronic calendars to schedule meetings, fosters a culture that accepts technology as "natural" to the business of everyday work.

The understanding of integration here is constructed on the basis of analyses, presented in earlier chapters, of measures of the availability and accessibility of equipment, infrastructure, software, and applications. The present chapter begins with three key questions that address what users—teachers, students, administrators—bring to the application of technology: their own skills and knowledge. The next three key questions focus on the incorporation of technology into instruction's major components: curriculum standards, practices, and student assessment. Finally, two key questions address the incorporation of technology into two major

Many groups have struggled to clarify the issue of defining technology integration. Although different words and phrases are used, the major theme of these definitions is that **technology is a tool or a means to an end goal—it is not the end in itself.** Here are three different takes on technology integration:

- "Boards of education need to recognize that technology integration is as much about change as it is about technology. How board members feel about change and their attitudes about people's ability to change or not change are crucial." National School Boards Association's *Leadership and Technology*
- "Technology integration is the process of teaching technology (technology education) and another curricular area simultaneously. In addition, it is the process of using technology to enhance teaching for learning (educational technology)." EdTech Connect, 1999
- "Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions—as accessible as all other classroom tools." National Educational Technology Standards for Students, International Society for Technology in Education

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**"Beyond Counting"**

The ratio of students to computers is a very poor measure of technology integration in school settings.

aspects of school management: the processes and practices themselves, and the evaluation of administrative and instructional staff.

Indicators related to teacher and administrator training may be found in Chapter 6, Professional Development. Indicators and data elements related to maintenance and support of software and hardware may be found in Chapter 5.

Obtaining measures for indicators in this chapter often requires purpose-built survey questions or other forms of assessment. Technology integration is one domain that may well require special data collections, although wherever possible in the handbook, indicators and data elements have been recommended that can be found in, or easily added to, existing record systems.

The indicators provided here are recommended because they will give useful, comparable information. It should be stressed that the handbook does not recommend a data collection, nor does any agency require that any of the data in this chapter be collected. Technology planners and administrators can choose what measures and standards best to apply in their districts. Enough indicators are given to provide examples; users will adapt these examples to their own school or district's situation, or develop new ones.

## Key Questions and Indicators

In order to obtain measures for the indicators in this chapter, the Technology in Schools Task Force has looked for standards that might provide criteria to which behaviors and practices could be compared. Standards for proficiency in the use of technology by students, teachers, and administrators have been mapped through the work of the International Society for Technology in Education and other national groups.

Standards are valuable in assessing technology integration to the extent that they provide reference points for measurement: rubrics or lists of authentic and observable performances that demonstrate the use of technology in context. Standards set measurable goals for technology integration; they do not assign value positions to the results of measurement. The issue of the desirability of technology integration relates to the links between technology adoption and educational or management outcomes, which are beyond the province of this guide. The lists of observable behaviors can be used by school and district personnel to think about what to measure, and consideration of what to measure in turn leads to thinking about how to measure it.

Three key questions deal with the incorporation of technology into teaching and learning standards, into student assessment, and into evaluations of instructional and administrative staff. It can truly be said that technology is integrated into schools when technology proficiencies and practices are incorporated into the fabric of the organization—the processes by which educational goals are set and promotions are determined.

## *Key Question 1. Are teachers proficient in the use of technology in the teaching/learning environment?*

The best indicator to measure proficiency is some form of performance measure based on clear and reasonable criteria. Two efforts are presented that address, respectively, the criteria to be employed and the measurement approach.

The first is the national standards established by the International Society for Technology in Education (ISTE), the Standards for Basic Endorsement in Educational Computing and Technology Literacy. These standards specify a desired performance profile for technology-literate teachers. Schools and districts can examine these performance standards to determine measures of teacher skills with technology. The assessment could be through portfolio-based ratings of teachers for a selection of performance areas. A sample performance area requirement from the ISTE standards is presented after the indicators for this question.

The second approach comes from Fairfax County Public Schools (FCPS) of Virginia. They have determined eight teacher technology competencies, divided into two competency skill areas: operational (standards 1–4) and integration (standards 5–8).

### Operational Standards

Instructional personnel shall be able to:

1. Demonstrate effective use of a computer system and utilize computer software.
2. Apply knowledge of terms associated with educational computing and technology.
3. Apply computer productivity tools for professional use.
4. Use electronic technologies to access and exchange information.

### Integration Standards

Instructional personnel shall be able to:

5. Identify, locate, evaluate, and use appropriate instructional hardware and software to support the Virginia Standards of Learning and other instructional objectives.
6. Use educational technologies for data collection, information management, problem solving, decision making, communication, and presentation within the curriculum.

7. Plan and implement lessons and strategies that integrate technology to meet the diverse need of learners in a variety of educational settings.
8. Demonstrate knowledge of ethical and legal issue relating to the use of technology.

[Reprinted with permission from Fairfax County Public Schools. See Resources for reference.]

The most frequent way that Fairfax County teachers meet the operational standards is by taking or teaching professional-level technology courses, by preparing a portfolio, or by taking an operational skills test. For the integration standards, teachers can complete coursework, serve as a technology course instructor, prepare a portfolio, or present at a conference. Many resources and training opportunities are available to help employees meet the technology standards, including school-based technology specialists, FCPS-sponsored credit classes, and computer-based instruction (available both on CD and on the Internet).

Finally, a rubric-based rating system could also be applied by external evaluators or school administrators. (For an example of a rubric-based system, see "Administrative Usage Rubric Objectives" at the end of Key Question 7.)

INDICATORS

| | |
|---|---|
| Extent of teacher user skills, fit to performance profile | Percentage of teachers achieving acceptable performance on standards-based performance profiles. |

SAMPLE REQUIREMENT, ISTE STANDARDS FOR BASIC ENDORSEMENT IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY (EXCERPTED)

1.0 Prerequisite Preparation – Foundations.
    1.1. Basic Computer/Technology Operations and Concepts
        Candidates will use computer systems – to run software; to access, generate, and manipulate data; and to publish results....
    1.2. Personal and Professional Use of Technology
    1.3. Application of Technology in Instruction
2.0 Specialty Content Preparation in Educational Computing and Technology Literacy.
    2.1 Social, Ethical, and Human Issues
    2.2 Productivity Tools
        Candidates integrate advanced features of technology-based productivity tools to support instruction
    2.3. Telecommunications and Information Access
    2.4. Research, Problem Solving, and Product Development
3.0 Professional Preparation
    3.1. Teaching Methodology
    3.2. Hardware and Software Selection, Installation, and Maintenance

There are 61 performance standards in all, organized into the major areas listed above. A typical item is "1.2.5 Demonstrate awareness of resources for adaptive/assistive devices for student with special needs."

Levels corresponding to acceptable performance need to be set for each item included in a scale. In addition, a scaling procedure would need to be defined, either in terms of a minimum threshold, or passing certain standards deemed to be especially important.

[Excerpted from **http://www.iste.org/standards/ncate/basic.html**. Reprinted with permission from *National Educational Technology Standards for Students: Connecting Curriculum and Technology,* Copyright © 2000. International Society for Technology in Education. For more information about the National Educational Technology Standards (NETS), contact Lajeane Thomas, Director, NETS Project, (318) 257-3923; ***lthomas@latech.edu***.]

## *Key Question 2. Are students proficient in the use of technology in the teaching/learning environment?*

The goal of placing technology in the classroom is to provide new ways for students to learn. Proper integration of technology will make the technology support these new ways of learning transparently. When students are able to choose and use technology tools to help themselves obtain information, analyze, synthesize, and assimilate it, and then present it in an acceptable manner, then technology integration has taken place.

Establishing and implementing technology literacy standards for students can help guide teacher efforts to integrate technology. In particular, lists of competencies such as those provided in the examples below define expectations for student performance and can help guide teacher activities in the context of the curriculum.

The ISTE National Educational Technology Standards (NETS) project has produced technology foundation standards for students. There are six categories:

1. Basic operations and concepts.
2. Social, ethical, and human issues.
3. Technology productivity tools.
4. Technology communications tools.
5. Technology research tools.
6. Technology problem-solving and decision-making tools.

[See **http://cnets.iste.org/sfors.htm**. Reprint permission granted by ISTE.]

In connection with these standards, a set of performance indicators has been created, the Profiles for Technology Literate Students, which describe the level of competency that students should have at completion of various grade levels. A sample of these performance indicators is provided after the indicators for this key question. These profiles, and the associated examples and scenarios that ISTE has developed, could be used as a basis for assessment.

Another basis of assessment comes from the Nonprint Media and Technology Literacy Standards developed by the National Research Center on English Learning & Achievement, which has divided technology competencies for grades K–12 into three skill areas: basic, critical, and construction skills.

The construction skills students should have by completion of elementary school are presented in the list that follows. They build upon the basic and critical skills found in the Nonprint Media and Technology Literacy Standards. Construction skills are competencies involving the creation and use of nonprint texts for developing ideas and opinions, for communicating and collaborating with others, and for enhancing problem solving and personal fulfillment. Construction skills include capabilities for composing, developing, integrating, and presenting.

Construction skill competencies (for elementary school students):

- Use computer-based writing tools to communicate thoughts, ideas, and stories.
- Use computer-based drawing tools to illustrate thoughts, ideas, and stories.
- Use digital cameras to illustrate thoughts, ideas, and stories.
- Use multimedia authoring tools in the creation of knowledge products.
- Use presentation software in the creation of knowledge products.
- Use WWW authoring tools in the creation of knowledge products.
- Use audio tapes for self-directed and/or extended learning.
- Use videos for self-directed and/or extended learning.
- Use technology resources for self-directed and/or extended learning.
- Use technology resources for problem solving.
- Create nonprint media for personal fulfillment.
- Explain basic strategies for revising, improving and updating nonprint media.
- Use telecommunications technologies to participate in collaborative projects.
- Work collaboratively to seek and/or communicate information in nonprint formats.
- Work collaboratively to create simple nonprint information products.

[Reprinted with permission from the National Research Center on English Learning & Achievement, Copyright © 1999. Albany Institute for Research in Education. All Rights Reserved. See Resources for reference.]

INDICATORS *(for term definitions and categories, see below)*

| | |
|---|---|
| Student instruction or training | Count of courses that include training or instruction in technology tool skills in their contents. |
| Extent of student user skills, fit to performance levels | Percentage of students who perform at or above grade-level-specific performance levels on standards-based profiles. |
| | Percentage of students demonstrating competency at the Basic Skills, Critical Literacies, or Construction Skills levels. |
| Use of assistive or adaptive technologies by students where appropriate | Percentage of students using computer-based assistive or adaptive technologies to compensate for disabilities or limitations. |
| | Percentage of classrooms with available computer-based assistive or adaptive technologies for students to compensate for disabilities or limitations. |

## TERM DEFINITIONS AND CATEGORIES

**Adaptive technologies**: External support that can be used to enhance a person's ability to function within his or her environment, such as advanced voice recognition systems, Braille computer displays, and text-to-speech programs. See also "assistive technologies."

**Assistive technologies**: Any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities. See also "adaptive technologies."

**Technology tool skills** (adapted from ISTE Standards for Basic Endorsement in Educational Computing and Technology Literacy, Standard 2.2. Productivity Tools):

- Use advanced features of word processing, desktop publishing, graphics programs, and utilities to develop professional products.
- Use spreadsheets for analyzing, organizing, and displaying numeric data graphically.
- Design and manipulate databases and generate customized reports.
- Use teacher utility and classroom management tools to design solutions for a specific purpose.
- Identify, select, and integrate video and digital images in varying formats for use in presentation, publications, and/or other products.
- Apply specific-purpose electronic devices (such as a graphing calculator, language translator, scientific probeware, or electronic thesaurus) in appropriate content areas.
- Use features of applications that integrate word processing, database, spreadsheet, communication, and other tools.

## SAMPLE PERFORMANCE INDICATORS FOR TECHNOLOGY LITERATE STUDENTS, GRADES 6–8, FOUND IN ISTE NETS PROFILES FOR TECHNOLOGY LITERATE STUDENTS (EXCERPTED)

(Numbers in parentheses below refer to the ISTE technology foundation standard(s) to which each indicator applies. See page 79 for standards.)

**Prior to completion of Grade 8, students will:**

1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use. (1)

2. Demonstrate knowledge of current changes in information technologies and the effect those changes have on the workplace and society. (2)
3. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse. (2)
4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, web tools) to support learning and research. (3, 5)
5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. (3, 6)
6. Design, develop, publish, and present products (e.g., web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom. (4, 5, 6)
7. Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom. (4, 5)
8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. (5, 6)
9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity, and of practical applications to learning and problem solving. (1, 6)
10. Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. (2, 5, 6)

[See ***http://cnets.iste.org/68pro.htm***. Reprint permission granted by ISTE.]

## *Key Question 3. Are administrators and support staff proficient in the use of technology in support of school management?*

Administrators will benefit from understanding and competently using technology themselves as they lead a school or district and set priorities. Experience as a hands-on user helps administrators understand the change process that schools must undergo and the requirements for successful technology integration. Effectively applying technology empowers administrators to manage with information and make data-driven educational decisions.

Standards for administrators identify a common focus for the role of leadership in enhancing learning and school operations through the use of technology. Standards by national organizations and state education departments represent a national consensus among educational stakeholders of what best measures effective school leadership for comprehensive use of technology in schools.

The first set of standards listed here has been published by a broad coalition of national principal, administrator, and school board organizations and is called the Technology Standards for School Administrators (TSSA). These standards may provide a basis for assessment of administrator competence with technology. A sample of the performance indicators that have been developed for these standards appears after the indicators for this key question. The standards cover six areas:

**I. Leadership and Vision**

*Educational leaders inspire a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of that vision.*

**II. Learning and Teaching**

*Educational leaders ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching.*

**III. Productivity and Professional Practice**

*Educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others.*

**IV. Support, Management, and Operations**

*Educational leaders ensure the integration of technology to support productive systems for learning and administration.*

**V. Assessment and Evaluation**

*Educational leaders use technology to plan and implement comprehensive systems of effective assessment and evaluation.*

**VI. Social, Legal, and Ethical Issues**

*Educational leaders understand the social, legal, and ethical issues related to technology and model responsible decision-making related to these issues.*

[See ***http://cnets.iste.org/tssa/view_standards.htm***. This material was produced as a project of the Technology Standards for School Administrators (TSSA) Collaborative.]

Another set of standards has been developed by the Utah State Office of Education's Technology for Principals Leading Utah's Schools (T-PLUS) project. It sets four primary goals and 12 objectives that can be adapted to establish administrator self-report or peer-review mechanisms to assess administrator proficiency. A sample performance indicator is also provided after the indicators for this key question. The four goals of T-PLUS are:

I. Identify and critique technology-supported learning environments that address instructional or performance improvement goals.

II. Oversee and manage a technology-integration project team and its process, including providing for relationships among all stakeholders.

III. Develop and justify strategies and tactics for introducing and integrating new technology tools and techniques based on change theory or a change model.

IV. Design and complete an action research project either individually or collaboratively with one or more other participants. The project will be field-based, data-driven, and reflective of outcomes based on a technological intervention.

[See ***http://www.wgu.edu/tplus/project.html***. Reprinted with permission from Technology for Principals Leading Utah's Schools (T-PLUS), Copyright © 2001. Utah State Office of Education and Western Governors University. All Rights Reserved.]

Administrative support staff may also benefit from developing proficiency in using technology. It is possible that standards could be developed from job requirement descriptions used in similar positions elsewhere in the business environment.

INDICATORS

| | |
|---|---|
| Extent of administrator user skills | Percentage of administrators achieving acceptable performance on standards-based performance profiles. |
| Extent of support staff user skills | Percentage of support staff achieving acceptable technology proficiency performance levels. |
| Patterns of administrator use | Percentage of administrators using computer-based technologies on a variety of administrative tasks. |
| Patterns of support staff use | Percentage of support staff using computer-based technologies on a variety of administrative tasks. |

## SAMPLE AREA FOR ADMINISTRATOR ASSESSMENT: PERFORMANCE INDICATORS FOR TSSA AREA III, PRODUCTIVITY AND PROFESSIONAL PRACTICE

*Educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others.*

**Performance indicators**

**Educational leaders**

A. model the routine, intentional, and effective use of technology.
B. employ technology for communication and collaboration among colleagues, staff, parents, students, and the larger community.
C. create and participate in learning communities that stimulate, nurture, and support faculty and staff in using technology for improved productivity.
D. engage in sustained, job-related professional learning using technology resources.
E. maintain awareness of emerging technologies and their potential uses in education.
F. use technology to advance organizational improvement.

***Role-Specific Technology Leadership Tasks***

**Superintendent**

*Superintendents who effectively lead integration of technology typically perform the following tasks:*

- establish a culture that encourages responsible risk-taking with technology while requiring accountability for results.

- maintain an emphasis on technology fluency among staff across the district and provide staff development opportunities to support high expectations.
- use current information tools and systems for communication, management of schedules and resources, performance assessment, and professional learning.

**District Program Director**

*District program directors who effectively lead integration of technology typically perform the following tasks:*

- use technology and connectivity to share promising strategies, interesting case studies, and student and faculty learning opportunities that support program improvement.
- model, for program staff, effective uses of technology for professional productivity such as in presentations, record keeping, data analysis, research, and communications.
- use online collaboration to build and participate in collaborative learning communities with directors of similar programs in other districts.

**Principal**

*Principals who effectively lead integration of technology typically perform the following tasks:*

- use current technology-based management systems to access and maintain personnel and student records.
- use a variety of media and formats, including telecommunications and the school web site, to communicate, interact, and collaborate with peers, experts, and other education stakeholders.

[Reprinted with permission from the Technology Standards for School Administrators (TSSA) Collaborative. See Resources for reference.]

### SAMPLE GOAL AND OBJECTIVES OF ASSESSMENT FOR SCHOOL ADMINISTRATORS, EXCERPTED FROM THE TECHNOLOGY FOR PRINCIPALS LEADING UTAH'S SCHOOLS (T-PLUS) PROJECT

***GOAL II:*** Oversee and manage a technology-integration project team and its process, including providing for relationships among all stakeholders.

Objective 4. Demonstrate knowledge of process management functions:

1. Appropriate feedback during the learning process.
2. Discussion mediation (synchronous, asynchronous, face-to-face).
3. Appropriate metacognitive coaching.

Objective 5. Demonstrate knowledge of resource management functions:

1. Classroom/media labs.
2. Managing software, version control.
3. Circulation/"housekeeping."

Objective 6. Initiate, propose, and justify implementation of new projects.

The user could be requested to provide a brief summary of events illustrating the accomplishment of one or more objectives under this goal, along with supporting materials.

[See ***http://www.wgu.edu/tplus/project.html***. Reprinted with permission from Technology for Principals Leading Utah's Schools (T-PLUS), Copyright © 2001. Utah State Office of Education and Western Governors University. All Rights Reserved.]

## *Key Question 4. Is technology integrated into the teaching/learning environment?*

Technology opens up many doors for students at all academic levels to do real work as they study a particular subject. Integrating a curriculum with technology involves making technology into a tool to enhance learning in a content area or multidisciplinary setting. The technology should become an integral part of how the classroom functions, as accessible as all other classroom tools.

Barriers to integration have included inadequate hardware and software, difficulties in securing sufficient funding, inadequate staff development, and deficiencies in planning. It is important to remember, however, that in general the presence of physical hardware in a classroom says little about whether and how it is used in instruction. A "head count" of computers should not be used to answer the indicators below, which are straightforward counts and percentages. Even counting the number of classes set in a computer-intensive "laboratory" setting may be inadequate as a measure of integration, since only technology-specific skills may be taught there. Instead, measurement should be based on observing actual access and usage.

A different sort of technology integration occurs with distance education. Offering courses with a remote teacher provides a school or district with an alternative way to extend the curriculum, and allows several districts to share a scarce or expensive resource (say, a Latin teacher). The number of distance education courses offered is an indication of the penetration of distance education into the school's instructional base.

INDICATORS *(for term definitions and categories, see below)*

| | |
|---|---|
| Patterns of teacher use | Percentage of teachers using computer-based technologies on a variety of instructional and instruction-related tasks. |
| Patterns of student use | Percent of students using computer-based technologies on a variety of instructional and instruction-related tasks. |
| Course delivery through distance education | Count of courses offered through both external (state or regional) and internal (district-wide) distance education. |

### TERM DEFINITIONS AND CATEGORIES

**Example list of instruction-related tasks for teachers**: Accessing information on instructional resources; communicating with colleagues or other professionals; creating instructional materials/tasks or visuals; downloading curriculum materials from the Internet; accessing libraries or resources on-line; participating in collaborative projects with remote classrooms or teachers; publishing instructional materials on the Internet; and communicating with parents.

**Example list of instruction-related tasks for students**: Gathering information from a variety of sources; organizing and storing information; performing measurements and collecting data in investigation or laboratory experiments; manipulating/analyzing/interpreting information or data to discover relationships, generate questions, and/or reach conclusions; communicating/reporting information, conclusions, or results of investigations; creating visual displays of data/information; communicating/interacting with others in the classroom/school/outside of school; planning, refining, and producing audio/visual presentations; planning, drafting, proofreading, revising, publishing written text; creating graphics or visuals; generating original pieces of visual art and/or musical composition; publishing student projects or materials at remote locations on the Internet; performing calculations; and developing a more complete understanding of complex material or abstract concepts.

## *Key Question 5. Are technology proficiencies and measures incorporated into teaching and learning standards?*

Incorporation of desired technology proficiencies into standards for students and teachers is an indication of technology integration into the vision for the curriculum. Although such incorporation may not be the same as direct evidence of use, it denotes institutional incorporation of the technology goals. Institutional buy-in of this sort, backed with support from teachers and parents and administrators, is the way to guarantee that the adopted innovation (such as technology) will not disappear when circumstances change.

INDICATORS

| | |
|---|---|
| Inclusion of technology in standards | General or subject-area (student) standards include items related to proficiency in the use of computer and networking technologies. |
| | The school or district has adopted standards for technology proficiency for students, but they are not integrated into general or subject-area standards for teaching and learning. |
| | Teacher standards include items related to proficiency in the use of computer and networking technology. |
| | The school or district has adopted standards for technology proficiency for teachers, but they are not integrated into general standards for teaching. |

### AN EXAMPLE OF STUDENT STANDARDS IN INSTRUCTIONAL TECHNOLOGY

**Instructional technology** should prepare the student for lifelong learning in a rapidly changing technological society by providing a basic understanding of technology usage, processes and systems. This knowledge is necessary for all students regardless of educational or career goals. The *Priority Academic Student Skills (PASS)* were written to provide utilization of technology throughout the curriculum. These priority skills were purposely designed to be broad in defining the basic skills for instructional technology statewide.

Each level of technology skill is built upon by previous levels. The skills addressed are:

- operation of the computer.
- application software as a tool.
- problem-solving skills.

- telecommunications skills.
- ethical and legal issues in technology.

Priority Academic Student Skills (PASS), Intermediate Level. The student will:

I. Operate a computer system in order to use software successfully.

II. Demonstrate the usage of a wide variety of application software.

III. Demonstrate skills in using productivity tools in problem-solving applications.

IV. Use computer-based technologies and/or telecommunications to access, synthesize and utilize information.

V. Investigate the growth and development of technology in career areas.

VI. Describe legal and ethical issues related to computers and telecommunications including, but not limited to such areas as computer copyright material, fair usage, privacy, security and computer viruses.

VII. Demonstrate appropriate keyboarding skills.

VIII. Determine appropriate computer applications for task performance (i.e., what technology applications are most appropriate for specific academic purposes).

[See ***http://www.sde.state.ok.us/home/home01_test.html?http://www.sde.state.ok.us/publ/pass.html!*** Reprinted with permission from the Oklahoma State Department of Education.]

## *Key Question 6. Are technology proficiencies and measures incorporated into student assessment?*

Two distinct ideas are brought together in this key question. On the one hand, there is interest in knowing if student assessments include measures of technology proficiency or utilization, whether directly (such as including items in a mathematics test that require use of a calculator) or indirectly (such as an assessment that involved a student presentation done in a computer graphics program, such as PowerPoint).

On the other, there is also interest in knowing to what extent the technologies are used in conducting assessments. The difference, then, is that the second issue is the use of technology in student assessment, while the first issue is the inclusion in student assessments about technology use.

INDICATORS *(for term definitions and categories, see below)*

| | |
|---|---|
| Inclusion of technology-related items in student assessments | Student assessments include items directly or indirectly related to technology proficiency or use. |
| Use of technology in student assessment | Count of student assessments that are technology-based, by assessment type. |

TERM DEFINITIONS AND CATEGORIES

**Technology-based student assessment types**: multiple-choice test administered via computer; adaptive multiple-choice test; open-ended response test; electronic portfolio.

Examples of student assessments of technology proficiency can be found at Kathy Schrock's Guide for Educators (***http://school.discovery.com/schrockguide/assess.html***). A number of rubrics and portfolio guidelines are given, including ones for Internet use, primary source utilization, multimedia, and others.

## *Key Question 7. Is technology incorporated into administrative processes?*

This key question addresses the extent to which technology is infused into the business and management of schooling, the daily routine processes that allow classes to take place. Buses come and go; people are fed; teachers are paid; attendance is taken; grades are posted; transcripts are sent out; halls are cleaned; and heating and air conditioning systems are maintained. Information passes back and forth between central office and school office, between principals and teachers, and between districts and states.

Data-driven decision making can pervade a school or district and lead to continuous school improvement. Administrators need to ask themselves questions such as, Which decisions do you currently make based on data? What decisions do you make that you would like to have more data for, to inform your decision making? What do our data tell us we are doing right? Where do our data tell us we need improvement? Do changes we make result in the improvements we anticipated? Are meaningful data on student and management performance regularly collected throughout the year, so that timely, appropriate, and targeted interventions can be applied when and where they are needed?

In all of these areas and more, there is a wealth of opportunities to communicate, and to gain in efficiency by more efficient communication. Computers support the organization and efficient communication of information; the integration of technology into management involves, at its core, the promotion of efficiencies in sharing information. Although these uses of technology may appear less glamorous than, say, allowing students to point a telescope remotely over the Internet, the potential effects of technology in school management are no less revolutionary than in other areas of enterprise management.

INDICATORS

| | |
|---|---|
| Integration into administrative tasks | Extent of student attendance computerization. |
| | Extent of staff attendance computerization. |
| | Computerization of staff/human resources management at the Local Education Agency (LEA) level: substitute management system that can be accessed anytime, record teacher absences, and provide substitute placement. Position control integrated with General Ledger. Payroll integrated with earnings history. |
| | Transportation management system: data (students, staff, and financial) are synchronized and available on handheld devices. |
| | Food service management system. |
| | Special education management system that includes basic data; Individualized Educational Program (IEP); placements; evaluations; automated scheduling, tracking, and notification system. |
| | The LEA has a curriculum management application. |
| | The LEA has a library management system. |
| | Percentage of administrative applications with web-based access. |
| | Building-level access security control systems. |
| | The LEA has a computerized fixed assets (capital assets) security and tracking management system, digital imaging system, access control system. |
| | The LEA has a food services point-of-sale (POS) system. |
| | An integrated management system exists that links two or more major administrative functions. |
| | Special education data are integrated with the LEA's student management system. |
| | Special education data are integrated with the LEA's transportation application. |
| | Building administrators and office staff have access to student data, financial data, and staff data. |
| | Building administrators and office staff utilize online budget development, purchase orders/requisitions, or action forms/board resolutions. |
| | Staff members have remote access to their payroll/benefits data, district policies, and/or attendance/sick time/vacation records. |

INDICATORS *(continued)*

| | |
|---|---|
| Integration into administrative tasks *(continued)* | Student administrative application provides dynamic online data related to student attendance. |
| | Financial administrative application provides dynamic online data related to school budgets and/or purchasing. |
| | Facility and equipment access ID system. |
| | Extracurricular activities ID system. |
| | Ratio of administrative applications hosted on-site vs. off-site. |
| Teacher use of technology for administrative purposes | Percentage of teachers using computer-based technologies on instruction-related administrative tasks. |
| | Percentage of teachers making data-driven decisions. |
| | Percentage of teachers with access to data warehouse/data mining tools. |
| | Percentage of teachers providing homework/lesson plans online. |

The indicators above will conceivably expand and may be augmented by standards as technology progresses into the administrative sphere. Evaluations of integration will become easier and more commonplace with new software packages that enable schools to link vital data from almost all recordkeeping spheres into a cohesive and seamless database. The indicators above are merely suggestions of what can be included in support of the school's business environment.

**Administrative Usage Rubric Objectives—Possible rubric to measure integration within administrative functions**

TECHNOLOGY INTEGRATION - ADMINISTRATIVE USAGE RUBRIC OBJECTIVES

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| STUDENT MANAGEMENT SYSTEM | "3," plus anywhere access to attendance data. Attendance is available in "real time." School does "period by period" attendance. Attendance is input into a "device" in "real time."<br>Monthly registers are processed centrally, the data are maintained at the classroom level, data are available at the district level.<br>Special education data are integrated with the LEA's student management system. The special education application is web based. The LEA has a library management system that is web based. The district's library holdings are available to community libraries. | "2," plus district access to attendance data. Attendance is available by mid-morning. School has ability to do "period by period" attendance but does not use that functionality.<br>Teachers complete bubble sheets that are later scanned for attendance. Monthly registers are processed at the building level, the data are maintained at the building level, data are available at the district level. The special education application is centralized. The LEA has a curriculum management application. The LEA has a library management system that is district based. | Student attendance is computerized, with building access to data. Computerized attendance is input and available at the end of the day or week.<br>Teachers take attendance manually and information is then entered into system. Monthly registers are processed at the building level, the data are maintained at the building level, online data are only available at the building level. The special education application is online and school based. The LEA has a library management system that is school based. | Student attendance is manually processed with attendance cards. Attendance is available on manual records at the end of the day. Monthly registers are processed manually and available at the building and district levels in "hard copy." |
| HUMAN RESOURCE MANAGEMENT | "3," plus staff attendance is available in "real time." Data processed at the | "2," plus staff attendance is available by mid-morning. Attendance is available | Staff attendance is computerized, with building access to online data for payroll purposes. | Staff attendance is manually processed for payroll purposes. Attendance is available |

## TECHNOLOGY INTEGRATION - ADMINISTRATIVE USAGE RUBRIC OBJECTIVES *(continued)*

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| HUMAN RESOURCE MANAGEMENT *(continued)* | building level is integrated into the payroll system. The LEA utilizes a substitute tracking system to identify and assign appropriate substitutes as needed.<br>The LEA utilizes a certificate tracking system to verify staff certification, identify appropriately certified staff to fill needs, or to identify subjects that need resources. Staff members with remote access to their payroll/ benefits data, district policies, and/or attendance/sick time/ vacation records can interact to initiate changes to benefits status, tax deductions, etc. | by mid-morning. Data are available online at the building and district levels.<br>The LEA utilizes a position control application to manage and fill vacancies without going over budget. Staff members have remote access to their payroll/benefits data, district policies, and/or attendance/sick time/vacation records. | Attendance is available online at the end of the day or week. Biweekly and/or monthly staff attendance data system generated for payroll purposes is available online at the building and in "hard copy" at the district level. | on manual records at the end of the day. Biweekly and/ or monthly staff attendance data are processed manually for payroll purposes and available at the building and district levels in "hard copy." |
| TRANSPORTATION MANAGEMENT | "3," plus the LEA is responsible for maintaining vehicle inspection data and bus driver certification/basic data. Special education data are integrated with the LEA's transportation application. | "2," plus the data for each building are available at the district level. | The LEA is responsible for transportation of students, and there is a database with bus routing information and transported student basic data at the building level. | The LEA is not responsible for transportation of students. |

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**TECHNOLOGY INTEGRATION - ADMINISTRATIVE USAGE RUBRIC OBJECTIVES** *(continued)*

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| FOOD SERVICE | "3," plus the LEA's food service department utilizes a point-of-sale cafeteria application. | "2," plus the LEA uses direct certification food service eligibility information available from the state.<br>The food service department utilizes a point-of-sale cafeteria application. | The LEA has an in-house or out-sourced food service program.<br>There is a student database with food service eligibility identified. | The LEA has no food service program, or the LEA has an in-house or out-sourced food service program with manual records of food service eligibility identified. |
| ACCESS | "3," plus the LEA's building access security control systems' information feeds student/staff attendance databases.<br>Anytime anywhere access to student, financial, human resource, transportation, and staff data. | "2," plus district access to student, financial, human resource, transportation, and staff data. The LEA has building access security control systems. | Teacher/building administrative access to student, financial, human resource, transportation, and staff data. | No access to online student, financial, human resource, transportation, and staff data. |
| FINANCIAL MANAGEMENT | "3," plus the warehousing and accounts payable/ receivable systems feed the fixed assets system. | "2," plus building administrators and office staff utilize online budget development, purchase orders/ requisitions, and/or action forms/ board resolutions. The LEA does a physical inventory of fixed assets at least annually. | Building staff have online access to budget and purchasing information.<br>The LEA's fixed assets are computerized and the LEA does a physical inventory of fixed assets at least every five years. | The LEA maintains manual systems, or the LEA utilizes manual systems at the building level that are then input to centralized systems at the central office. The LEA keeps manual fixed assets records and does not do a physical inventory at least every five years. |

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### *Key Question 8. Is technology proficiency integrated into the evaluation of instructional and administrative staff?*

As with Key Question 5 (on the incorporation of technology-related items into teaching standards), this key question addresses an issue that represents the incorporation of technology into the institutional fabric of school systems. There is no better driver of technology integration (or, at least, incorporation) into classrooms than the inclusion of technology-related dimensions or items in teacher evaluations; the same notion applies to administrators and support staff.

INDICATORS

| | |
|---|---|
| Inclusion of technology-related items in teacher evaluation | Teachers are required to demonstrate proficiency or obtain a certification in technology. |
| | Items related to technology proficiency, use, or technology integration in instructional settings are included in teacher evaluations. |
| Inclusion of technology-related items in evaluations of administrators and support staff | Assessment of technology proficiency or use is a component of administrator or support staff evaluation procedures. |

In connection with the first of the indicators above, the user is reminded of the Fairfax County, Virginia, technology proficiency assessment system described in connection with Key Question 1 earlier in this chapter.

## Unit Record Structure

Many of the indicators presented in this chapter can only be measured through specific data collection efforts, with forms filled out by the local technology coordinator, lead teachers, administrators, or staff members. The unit record structure presented in other chapters, in which data routinely collected for a variety of purposes can be converted into indicators that provide responses to key questions on the presence of technology, is not really appropriate for the information provided here.

## Resources

"Critical Issue: Promoting Technology Use in Schools," *Pathways to School Improvement*, North Central Regional Educational Laboratory. See ***http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te200.htm***

"Critical Issue: Using Technology to Improve Student Achievement," *Pathways to School Improvement*, North Central Regional Educational Laboratory. See ***http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm***

Eastwood, K., Harmony, D., and Chamberlain, C. (1998). "Integrating Technology into Instruction, How We Became One of the Best by Simply Listening," *Curriculum Technology Quarterly*, Association for Supervision and Curriculum Development.
See ***http://www.ascd.org/readingroom/ctq/framemain.html***

Sulla, N. (1998). "Winning Teachers Over," *Electronic School*.
See ***http://www.electronic-school.com/0398f2.html***

*Using Data to Improve Schools: What's Working*. (2002). American Association of School Administrators.
See ***http://www.aasa.org/cas/UsingDataToImproveSchools.pdf***

Withers, S.R. (1999). "Making the Best Use of New Tools: Standards for Integrating Technology," *English Update*, newsletter of the National Research Center on English Learning & Achievement.
See ***http://cela.albany.edu/newslet/fall99/shelly.htm***

## *Standards*

National Educational Technology Standards (NETS) Project, International Society for Technology in Education (ISTE).
See, especially NETS for Teachers and NETS for Students,
***http://cnets.iste.org/***

National Standards for Technology in Teacher Preparation, by the National Council for Accreditation of Teacher Education (NCATE).
See ***http://www.iste.org/standards/ncate/index.html***

Standards for School Administrators: A Proposed Model (1997), by the Southern Regional Education Board (SREB) and the Educational Technology Cooperative, which comprises 38 state higher education and K–12 coordinating and governing boards.
Search archives at ***http://www.sreb.org***

Swan, K. "Nonprint Media and Technology Literacy Standards for K–12 Teaching and Learning." National Research Center on English Learning & Achievement.
See ***http://cela.albany.edu/standards/index.html***

Technology Standards for School Administrators (TSSA) Collaborative.
See ***http://cnets.iste.org/tssa/***

Technology for Principals Leading Utah's Schools (T-PLUS), Utah State Office of Education and Western Governors University.
See ***http://www.wgu.edu/tplus/overview.html***

## Assessment tools

Ted Nellen lists many tools for assessing staff for technology on his own web site.
See **http://www.tnellen.com/school/assess.pdf**

Learning with Technology Profile Tool, North Central Regional Educational Laboratory.
See **http://www.ncrtec.org/capacity/profile/profwww.htm**

Arizona State recently created an online web assessment tool for all of their public school teachers.
See **http://mycompass.asset.asu.edu/**

Computer Strategies.
See **http://www.compstrategies.com/staffdevelopment/index.html#ILP**

The Milken Family Foundation's Professional Competency Continuum (PCC) Assessment Tool.
See **http://www.mff.org/publications/publications.taf?page=280**

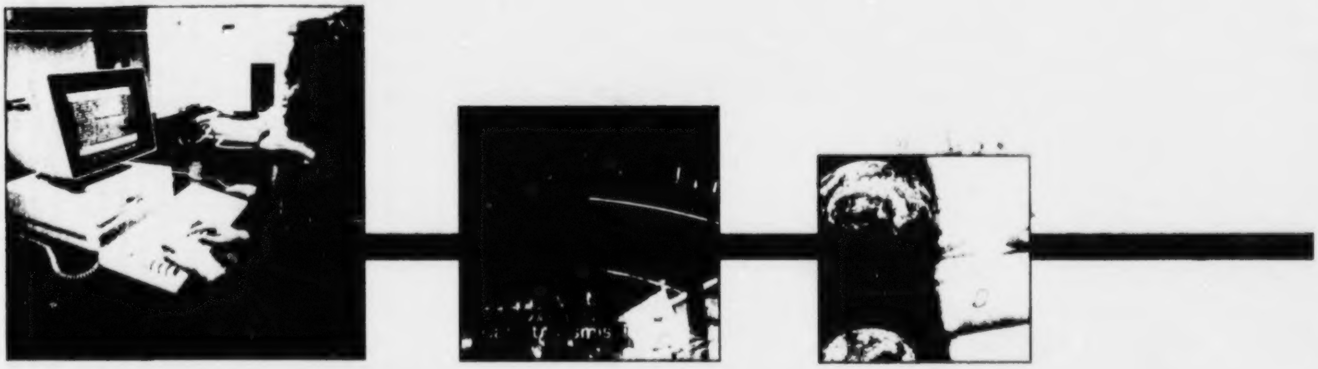
## Other in-depth resources

enGauge: Educator Proficiency.
See **http://www.ncrel.org/engauge/framewk/pro/proin.htm**

The Milken Family Foundation Initiative on Education Technology.
See **http://www.mff.org/edtech/**

"Teachers and Technology: Making the Connection," U.S. Congress, Office of Technology Assessment, April 1995.
See **http://www.wws.princeton.edu/%7Eota/disk1/1995/9541.html**

Fairfax County Public Schools, *Guide for Implementing the Virginia Technology Standards,* Virginia Dept. of Education.
See **http://www.fcps.edu/dis/OTIS/tsip/guide.pdf.**
For technology standards statutory authority, see **http://www.pen.k12.va.us/VDOE/Compliance/TeacherED/tech.html**



# Glossary

## Sources

There are two prior Forum publications in the area of technology: *Technology @ Your Fingertips* (Revised 2001) (NCES 98-293r) and *Safeguarding Your Technology* (NCES 98-297). Wherever terms in the current document appeared in these prior publications, the glossary definition used there is provided below and the source is noted.

[**TiS**] *Technology in Schools* Handbook

[**T@YF**] *Technology @ Your Fingertips*

[**SYT**] *Safeguarding Your Technology*

## [A]

**Acceptable use policy (AUP)** [SYT; T@YF]: A policy designed to limit the ways in which a computer or network can be used. Acceptable use policies usually include explicit statements about the required procedures, rights, and responsibilities of a technology user. Users are expected to acknowledge and agree to all AUP stipulations as a condition of system use, as should be certified on the AUP by the user's signature.

**Adaptive technologies** [TiS]: External support that can be used to enhance a person's ability to function within his or her environment, such as advanced voice recognition systems, Braille computer displays, and text-to-speech programs. See also **assistive technologies**.

**Administrative software** [SYT]: Computer programs that are used to expedite the storage and use of data and information. Examples of administrative software include student records systems, personnel records systems, and transportation mapping packages.

**Administrative staff** [TiS]: School personnel primarily engaged in administration, management, or support roles, as opposed to instruction.

**Age grouping (of computers)** [TiS]: Grouping computers by time elapsed between date of purchase and the present; see also **up-to-date (computer)**.

**Alignment (of software with curriculum standards)** [TiS]: The process of determining the extent to which instructional software supports specific standards for teaching and learning in a curriculum area.

**Assistive technologies** [TiS]: Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities. See also **Adaptive technologies**.

## [B]

**Back up** [SYT; T@YF] (Verb): To make a copy of a file or program for the purpose of restoring the data if the masters were to be lost, damaged, or otherwise unavailable for use.

**Backup** [SYT; T@YF] (Noun): A copy of a master file or program. To be most effective from a security standpoint, backups are frequently stored at off-site locations.

**Bandwidth** [TiS]: The speed (usually expressed in kilobits per second [Kbps] or megabits per second [Mbps]) of the telecommunications link between a computer and a local-area network and/or an Internet service provider (ISP), routing service, or other method of connection to the Internet. Example of bandwidth level ratings: 33.6 Kbps or under; 56 Kbps; 128 Kbps; 256 Kbps; 512 Kbps; 768 Kbps (.5 T1); T1; Ethernet; DS(1) or higher.

**Bit** [SYT; T@YF]: A binary digit. The smallest unit of computer memory, eight of which constitute a byte. The value of each bit, as limited by the "binary" code read by computers, is either 0 or 1. See also **Byte** and **Megabyte**.

**Browser** [SYT; T@YF]: See **Web browser**.

**Byte** [SYT]: Eight bits. The amount of computer memory needed to store one character (i.e., a number, letter, or symbol). See also **Bit** and **Megabyte.**

## [C]

**Cable modem** [TiS]: Hardware that encodes and decodes computer-based communications for transmission over a cable television system.

**CD** [TiS]: See **Compact Disc**.

**CD-ROM (Compact Disc-Read Only Memory)** [SYT]: An optical disk capable of storing large amounts of embedded electronic programs or files that can only be *read from* the disk (i.e., data can not be *written to* the disk after it has been produced). Unlike diskettes, CD-ROMs can be read by any type of computer with a CD-ROM disk drive. See also **Compact disc** and **Diskette**.

**Central processing unit (CPU)** [SYT]: The main chip that controls the operation of the rest of the computer (i.e., the computer's "brain," where instructions are processed and information flow is managed). In a personal computer, a microprocessor serves as the CPU.

**Classroom** [TiS]: The location in a school in which instructional services are regularly provided to groups of students. See also **Instructional setting**.

**Client** [SYT]: The computer (user) in a client/server network that requests the files or services. The computer that supplies the services is the server. See also **Thin client**, **Server**, and **Client/server network**.

**Client/server networ**k [SYT]: A network configuration in which all users access files stored on a central computer or several central computers. Each central computer is a server, and each user (actually each user's computer) is a client. See also **Client**, **Thin client**, **Server**, **Peer-to-peer network**, and **Network**.

**Commercial service provider** [T@YF]: A company that will connect one computer to other computers for the exchange of information.

**Compact Disc** [SYT]: A 4.75-inch optical disk that can store computer files and data, audio signals, video images, and other digital files. Compact discs are published in a variety of formats, including a read-only format (which are then called CD-ROM for Compact Disc-Read Only Memory), but when not configured as such, can be written to as well. See also **CD-ROM**.

**Computer** [T@YF]: An electronic device that stores, retrieves, and processes data, and can be programmed with instructions. A computer is composed of hardware and software, and can exist in a variety of sizes and configurations.

**Computer laboratory** [TiS]: An instructional setting in which computers are clustered; usually used by a group of students or a class and reserved in advance for teaching such topics as word processing or computer programming.

**CPU** [SYT]: See **Central processing unit**.

## [D]

**Data** [SYT]: Raw information that lacks the context to be meaningful (e.g., "34" is data because it has no meaning unless some context is provided; "34 *degrees Fahrenheit*" has meaning and therefore becomes information). The terms "data" and "information" are often used to differentiate between computer-read (i.e., data) and human-read (i.e., information) figures and text. See also **Information**.

**Data element** [TiS]: A single entry of recorded information in a database. For example, the date of purchase for a computer is a data element, and the current date is another one. A "data element" may also be regarded as the "answer" to a survey question. See also **Indicator**, **Key question**, and **Unit record**.

**Database** [SYT]: A large collection of data that is developed and maintained for quick searching and retrieving. See also **Data** and **Database software**.

**Database software** [SYT; T@YF]: Computer programs designed to store large amounts of data and that allow for quick and efficient searching, retrieving, sorting, revising, analyzing, and ordering. There are two common types of databases, flat file databases and relational databases. See also **Data** and **Administrative software**.

**Decision support tool** [TiS]: Software that organizes information to support planning, budgeting, or other priority-setting activities.

**Diskette** [SYT]: A thin plastic disk on which computer programs and data can be saved outside of a computer. The two types of diskettes, also called floppy disks, are 3.5-inch disks that come in a hard plastic case and 5.25-inch disks that come in thin, pliable, cardboard-like cases.

**Distance education, distance learning** [TiS]: Any of a number of technologies involving course-taking or educational participation at a distance, with synchronous or asynchronous communication, between student and teacher.

**DSL (Digital Subscriber Lines)** [T@YF]: This technology uses existing copper pair wiring that exists in almost every home and office. Special hardware attached to both the user and switch ends of line allows data transmission over the wires at far greater speed than the standard phone wiring.

**DVD-ROM (Digital Video Disc-Read Only Memory)** [T@YF]: A disc like a CD-ROM that has more storage (4.7 gigabytes) and can provide digital video.

## [E]

**Educational technology** [TiS] [From ISTE National Educational Technology Standards (NETS)]: "Educational computing and technology encompasses knowledge about and use of computers and related technologies in (a) delivery, development, prescription, and assessment of instruction; (b) effective uses of computers as an aid to problem solving; (c) school and classroom administration; (d) educational research; (e) electronic information access and exchange; (f) personal and professional productivity; and (g) computer science education."

**Electronic data interchange (EDI)** [SYT]: The exchange of routine education (and business) information transactions in a computer-processable format.

**Electronic mail (E-mail)** [TiS]: Asynchronous (time-independent) messages sent from a user to one or more recipients over computer networks. Contrast with synchronous (time-dependent) messaging systems such as Internet chat.

**E-mail address** [T@YF]: An identifying address for a user's mailbox; characters identifying the user are followed by the @ symbol and the address of the mailbox's computer.

**Electronic mail (e-mail) software** [T@YF]: The computer programs that facilitate computer-to-computer communications among users in any location.

**Extranet** [T@YF]: The part of a company or organization's internal computer network that is available to outside users; for example, information services for customers.

## [F]

**File** [SYT]: In technology systems, a file is a block of data stored on a magnetic medium such as a floppy disk, hard disk, or tape. A file may contain a computer program, a document, or other collections of data and information.

**Firewall** [SYT;T@YF]: An electronic boundary that prevents unauthorized users and/or packets of data or information (e.g., files and programs) from accessing a protected system.

**Flat file database** [T@YF]: A database where information is stored in a single table (e.g., a table in which there is a list of employees, where data about each employee follow the name).

**Floppy disk** [SYT]: See **Diskette**.

**Frequently asked questions (FAQs)** [T@YF]: A listing of questions typically asked, along with the answers to the questions. This list is prepared to help novice users as they begin to use computers or software.

**Full-time equivalent (FTE)** [TiS]: Translation of hours of labor into equivalent units of full-time work, usually at the rate of eight hours to one full-time day.

**Functional specifications** [T@YF]: A document that states in detail what a new (or upgraded) computer system should be expected to do, i.e., what services it delivers to those who will use and maintain it. This listing of a computer system's capabilities can be compared to what can be bought from a commercial vendor or built by developers.

**Functions** [SYT; T@YF]: The tasks or actions that software is intended to perform. See **Software functions** and **System functions**.

## [G]

**Graphing calculator** [TiS]: An electronic calculator that has the capability to compute and display functions in graphical form.

## [H]

**Hacker** [SYT]: An unauthorized user who attempts to access a system and its information.

**Hardware** [T@YF]: The computer equipment used to do the work (i.e., operate software programs). It consists of the items you can touch, such as the computer case and the peripherals (e.g., monitor, keyboard, mouse) that are attached to the computer.

**Help desk** [SYT]: A source from which computer, network, or software users can receive assistance. Access to a Help desk is usually offered to users via telephone, fax, or e-mail.

**Home page** [T@YF]: The introductory page on a web site that usually contains a table of contents for the site and hot links to other pages. See also **World Wide Web (WWW)**.

**HTML (Hypertext markup language)** [T@YF]: The formatting language used to create Web pages and specify how a page will appear on screen.

**Hub** [T@YF]: A device that links all client computers to the server.

**Hypertext** [T@YF]: Text that contains links to other parts of a document or to documents held on another computer.

## [I]

**Indicator** [TiS]: The meaning or value assigned to a variable (i.e., the measure of a condition) in terms of its ability to demonstrate/show something. In handbooks relating to the collection of educational data from the National Forum on Education Statistics, indicators are quantitative measures that answer **key questions**.

**Information** [SYT]: Data that are meaningful (i.e., they are presented in a context that allows them to be read by a human as opposed to being read by a computer). See also **Data**.

**Instructional management software** [T@YF]: The computer programs that serve as tools to be used by teachers to prepare for instruction and maintain records. Some typical instructional management applications include gradebook programs and curriculum builders such as crossword puzzle generators.

**Instructional setting** [TiS]: Any setting in a school in which regular instruction is provided, such as a classroom or laboratory. See also **Classroom**.

**Instructional software** [SYT]: Computer programs that allow students to learn new content, practice using content already learned, and/or be evaluated on how much content they currently know. These programs allow teachers and students to demonstrate concepts, perform simulations, and record and analyze data. Sometimes application software such as database programs and spreadsheets can also be used within the instructional context to help analyze and present data and information. See also **Administrative software**.

**Instructional support applications** [TiS]: Software or computer-based systems that support instruction or instructional management. Examples include lesson planning software and student attendance systems.

**Integrated Services Digital Network (ISDN)** [SYT]: An international set of telecommunication standards that allow voice, video, and data to be digitally transmitted over wire or optical fiber lines.

**Internet** [T@YF]: A world-wide network of computer networks through which people can exchange data and communications.

**Internet connection** [TiS]: A telecommunications link between a computer or a local-area network and the global Internet. Examples of connection types: dial-up via modem; wired LAN and router; wireless LAN and router; cable modem; satellite/modem hybrid link; full satellite (two-way) link.

**Internet phone, voice-over-IP (VoIP)**: Telephone communications, usually long-distance, using the Internet as part of the communications link.

**Internet Service Provider (ISP)** [SYT]: An organization that provides access to the Internet. Commercial providers, nonprofit organizations, and schools can serve as ISPs. See also **Internet**.

**Intranet** [T@YF]: A localized network of computers that is used to communicate electronically within that specific area.

**ISDN** [SYT]: See **Integrated Services Digital Network**.

**ISP**: See **Internet Service Provider.**

## [K]

**Key question** [TiS]: Those questions that become central and organizing inquiries that reflect the concerns of policy makers and decision makers, school administrators, researchers, or the interested public. Questions whose answers are of particular interest to decision makers. See also **indicator** and **data element**.

**Kilobit**: 1,024 ($2^{10}$) bits.

**Kilobyte**: The amount of memory required to store 1,024 ($2^{10}$) characters.

## [L]

**LAN** [SYT]: See **Local area network**.

**Laboratory (computer)** [TiS]: See **Computer laboratory**.

**Laptop** [SYT]: A portable personal computer that is small enough to fit on a person's lap (i.e., it weighs less than eight pounds). Laptops are usually capable of being powered by rechargeable batteries. See also **Computer**.

**Library** [SYT]: See **Media library**.

**Local area network (LAN)** [SYT]: An interconnected system of computers and/or peripheral equipment (e.g., printers) that is confined to a limited area, such as a room, building, or campus, and enables connected users to communicate and share information and resources. See also **Wide area network (WAN)**.

## [M]

**Maintenance contract** [SYT]: An agreement with an outside service or agency (e.g., the vendor who sold the equipment) to maintain or repair a computer system (and its peripheral equipment).

**Media library** [SYT]: An on-site location that serves as a repository for archived files and software, and allows for security measures to be concentrated and even intensified. Note that a media library is not a substitute for off-site storage of backups. See also **Off-site storage.**

**Megabit**: 1,048,576 ($2^{20}$) bits.

**Megabyte (MB)** [SYT; T@YF]: The amount of computer memory needed to store 1,048,576 ($2^{20}$) characters (which is roughly equivalent to a novel of average length). Megabytes are used to describe the amount of memory on a diskette, hard disk, or in random access memory (RAM). See also **Bit** and **Byte**.

**Megahertz (MHz)** [SYT; T@YF]: A measure of the clock speed of a central processing unit (CPU) expressed in millions of cycles per second. See also **Central processing unit (CPU)**.

**Modem** [TiS]: Originally short for "modulator-demodulator," a device that converts digital signals to analog ones (and vice versa) suitable for transmission over telephone lines. A device used to connect computers to one another via telephone lines, television cable, or other forms of connection such as ADSL.

**Monitor** [T@YF]: A device similar to a television screen that receives video signals from the computer and displays the information for the user.

**Mouse** [T@YF]: A handheld pointing device (used on top of a desk) that gives directions to the computer and moves information around on a monitor screen.

**Multimedia** [T@YF]: A computer capable of utilizing more than one communication medium such as CD-ROM, DVD, speakers, etc.

**Multimedia computer** [TiS]: Computers capable of running Windows 95 or Macintosh OS 8.0 or later operating systems, with chipsets such as the Intel 486 or Motorola 68040 or better, with at least 16 MB of random-access memory (RAM), with CD-ROM or DVD player, and with a sound card, manufactured in the five years prior to data collection.

**Multitasking** [T@YF]: The concurrent execution of several jobs.

## [N]

**Needs assessmen**t [SYT]: The process of determining the system functions and software functions that an organization or user will require of a computer or network (i.e., what the system will be "needed" to do). The product of a needs assessment is initially a list of functional specifications and, ultimately (when completed and combined with the system's technical requirements), a needs statement. See also **System functions**, **Functional specifications**, **Technical requirements**, and **Needs statement**.

**Needs statemen**t [SYT]: A description of the functional specifications, technical requirements, and security standards that dictate the selection of a technology solution. Accurate needs statements usually require input from a range of potential users and are the product of a needs assessment. See also **Functional specifications**, **Technical requirements**, and **Needs assessment**.

**Network** [SYT]: A group of computers (technically, two or more) connected to each other to share software, data, files, and peripheral equipment. Also, the hardware and software needed to connect the computers together. See also **Local area**

**network (LAN)**, **Wide area network (WAN)**, **Client/server network**, **Peer-to-peer network**, **Intranet**, **Internet**, and **World Wide Web (WWW)**.

**Node** [SYT]: A point of access on a network (i.e., a point of connection). See also **Network**.

## [O]

**Off-site** [SYT]: A location other than an organization's primary work site or place of business. See also **Off-site storage**.

**Off-site storage** [SYT]: A location for the storage of backups that is physically independent of the primary site of file use. The purpose of off-site storage is to decrease the likelihood of a single catastrophic event damaging or destroying both the master files (originals) and any backups. For example, if a fire were to break out in a building, it is conceivable that the entire structure could be destroyed. If backups were maintained in that building, they would probably be lost with the master files; but if the backups were at a different location (i.e., in off-site storage), they would be much more likely to survive the event.

**On-line** [SYT]: The status of being connected to a computer or network or having access to information that is available through the use of a computer or network. See also **Remote access**.

**Operating system software** [T@YF]: The electronic instructions that control the computer and run the programs. This software is generally specific to a type of computer (e.g., Windows 95, Windows 98, Windows NT).

## [P]

**Peer-to-peer network** [SYT]: A network configuration in which each user stores files on his or her own computer for other network users to access. See also **Client/server network** and **Network**.

**Peripheral** [T@YF]: A device that is attached to a computer, such as a monitor, keyboard, mouse, modem, CD-ROM, DVD, printer, scanner, or speakers.

**Peripheral equipment** [SYT]: Any of a variety of devices that are attached to a computer, including monitors, keyboards, modems, printers, scanners, and speakers. See also **Monitor** and **Modem**.

**Project management software** [T@YF]: Software programs that provide tools to help manage projects, such as integrated calendars, report generators, scheduling, charting, tracking, prioritizing, etc.

**Project team** [T@YF]: The group of persons responsible for carrying out the successful implementation of the technology solution.

**Protocol** [T@YF]: The set of standards and rules, such as Ethernet or token ring, that lets networked computers communicate or share information.

## [R]

**Relational database** [T@YF]: A database where data are stored in more than one table, each one containing different types of data. The different tables can be linked so that information from the separate files can be used together.

**Remote access** [SYT; T@YF]: The act of accessing a computer or network from a location that is removed from the physical site of the computer or network. Remote access is often accomplished via the use of a modem. See also **Modem**.

**Resources** [SYT]: See **Technology resources**.

**Resolution** [T@YF]: The clarity of the images produced on a monitor screen.

**Router** [T@YF]: A device that regulates network traffic as its enters another network, and makes sure that messages go to the correct network site.

## [S]

**Scanner** [T@YF]: An input device that takes in an optical image and digitizes it into an electronic image represented as binary data. This can be used to create a computerized version of a photo or illustration.

**Screen saver** [T@YF]: A computer program that automatically displays a moving image or pattern on a monitor screen after a pre-set period of inactivity.

**Search engine** [T@YF]: Software that searches for specific information or files on the Internet using search criteria that you enter.

**Security** [T@YF]: Protection from threats to the equipment, functioning, and contents of a technology solution.

**Security audit** [SYT]: A methodical examination and review of system and user activity.

**Security policy** [SYT]: Clear, comprehensive, and well-defined plans, rules, and practices designed to protect and regulate access to an organization's system and the information that comprises it. The security policy describes the ideal status toward which all organizational security efforts should lead.

**Server** [SYT]: The computer in a client/server network that supplies the files or services. The computer (user) that requests the services is the "client." See also **Client**, **Thin client**, and **Client/server network**.

**Software functions** [SYT]: The tasks, activities, or operations that a piece of software is intended to perform. See also **Functional specifications**, **Needs assessment**, and **System functions**.

**Spreadsheet software** [T@YF]: Computer programs (e.g., Excel, Lotus) that have efficient and accurate methods of working with numbers. They are used to perform a wide variety of simple to complex calculations, and offer charting and graphing capabilities.

**Standards** [TiS]: Guidelines for developing curriculum and guiding teacher and student behavior. Standards define a common agreement on what ought to be taught or learned.

**Standards for technology competency** [TiS]: Guidelines that specify what a teacher or a student ought to know and be able to accomplish with technology.

**Steering committee** [T@YF]: A group of persons who meet periodically to evaluate the progress and success of the implementation of the technology solution.

**Storage media** [SYT]: Any of a variety of agents or mechanisms for storing electronic data or files, including disks, tapes, and compact discs. See also **Diskette** and **Compact disc**.

**Student** [TiS]: Person enrolled in a school, whether part or full time.

**Surfing** [SYT]: The act of exploring locations and browsing contents of World Wide Web sites on the Internet. See also **Web browser**.

**System** [SYT; T@YF]: A group of elements, components, or devices that are assembled to serve a common purpose. In a technological system, this refers to all hardware, software, networks, cables, peripheral equipment, information, data, personnel, and procedures (i.e., all technology resources) that comprise a computer environment. See also **Hardware**, **Network**, **Information**, **Data**, **Technology resources**, and **System functions**.

**System functions** [SYT]: A list of the specific capabilities a computer or network should be able to perform (or staff should be able to do when using the system). Examples of possible functions include storage and retrieval capabilities, calculation and processing capabilities, reporting and output capabilities, and telecommunications capabilities. See also **System**, **Functional specifications**, **Needs assessment**, and **Software functions**.

## [T]

**TCP/IP (Transmission Control Protocol *over* Internet Protocol)** [SYT]: The *de facto* standard communications protocol used for networking. See also **Network** and **Protocol**.

**Teacher** [TiS]: Instructional leader in a school setting.

**Technical requirements** [SYT]: Straightforward statements that describe the necessary parameters of a technology solution. These parameters should address topics such as the number of people who will use the system at a single time; where users are located; the numbers and types of transactions that need to be processed; and the types of technology components that need to interact. See also **Software functions**, **System functions**, and **Needs assessment**.

**Technical support staff** [SYT]: Those persons who support and maintain an information system once it has been established. See also **Technology resources**.

**Technology in Schools** [TiS]: The collection of electric and electronic devices, and related institutional and individual behaviors and practices, that are used in support of administrative and instructional applications in public and private educational settings in the United States. See also **Educational technology**.

**Technology resources** [T@YF]: The hardware, software, networks and networking capability, staff, dollars and context which together can be used in the implementation of a technology solution.

**Telecommuter** [SYT]: An individual who works at home or at another location that is physically removed from a place of employment via the use of technology (e.g., computers, modems, and fax machines). See also **Remote access**.

**Thin client** [SYT]: A networking system in which the client (i.e., the user's computer) in a client/server network handles very little of the processing because the majority of processing is managed by the server. See also **Client**, **Server**, **Client/server network**, and **Network**.

**Tool skills** [TiS]: The basic abilities needed to operate computers and computer-based applications.

## [U]

**Unit record** [TiS]: A collection of data elements for a given object. A row in a database. For example, to define a computer, various data elements are needed (e.g., speed, CPU, network card, etc.). The unit record (or elements from it) may be proposed as the answer to a question (e.g., How many multimedia computers are in the school?). See also **Data element**.

**Up-to-date (computer)** [TiS]: Computer manufactured within five years prior to data collection. See also **Age grouping (of computers)**.

**Upgrade** [T@YF]: To install a higher version or release of software on a computer system, or to add memory or newer types of equipment to a computer system.

**URL (Uniform resource locator)** [T@YF]: A World Wide Web address composed of several parts, including the protocol, the server where the resource resides, and the path and the file name of the resource. Example: http://nces.ed.gov.

**User** [SYT]: In information and technology systems, a user is a person who accesses a system. Education organization users typically include (1) instructional staff who provide instruction or perform instructional management tasks using technology and (2) administrative staff who use technology to manage the routine and non-routine administrative activities of an organization as efficiently as possible. Students, parents, and community members can also be users.

**Utility software** [T@YF]: Computer programs that help to manage, recover, and back up files.

## [V]

**Variable**: A basic term in the social sciences, one of a number that helps give specific definition to entities in the social sciences. A concept associated with an operation of observation or measurement; the essence of its definition is that it takes on different values for members of a group. In the present document, the term **indicator** corresponds most closely to the usual definition of a variable in the social sciences.

**Version** [SYT]: A major edition of a computer program. The version number changes when a software developer makes major alterations to the software (e.g., significant new features are added). The version number is a *whole* number following the name of the software, in contrast to the release number, which is the *decimal* number after the version number. For example, when Software 2.0 undergoes minor changes, it could be *re-released* as Software 2.1. When it later undergoes significant revamping, the new *version* would be Software 3.0. See also **Upgrade**.

**Videoconferencing** [TiS]: Interactive video-based communication. Two-way (or multi-way) videoconferencing involves video links between all participants; one-way videoconferencing involves video in one direction, with audio links in the other.

## [W]

**WAN** [SYT]: See **Wide area network**.

**Web** [SYT]: See **World Wide Web (WWW)**.

**Web browser** [T@YF]: Software that allows a user to locate, view, and access information from World Wide Web sites via the use of a graphical interface (e.g., Internet Explorer, Netscape).

**Wide area network (WAN)** [SYT]: An interconnected system of computers and networks (including local area networks) that surpasses local area networks in scope (e.g., WANs can span building to building, city to city, across the country, and internationally). These data communications linkages (e.g., dedicated lines and radio waves) are designed to allow large numbers of users to communicate and access information. See also **Local area network (LAN)**.

**Wireless** [SYT]: A network system in which there is no physical connection between two pieces of equipment (i.e., instead of a wire or fiber optic links connecting computers, they communicate via radio waves). See also **Network**.

**Word processing software** [T@YF]: Computer programs that allow documents to be typed, revised, formatted, and printed quickly and efficiently (e.g. Word, WordPerfect).

**World Wide Web (WWW)** [T@YF]: A system that allows access to information sites all over the world using a standard, common interface to organize and search for information. The WWW simplifies the location and retrieval of various forms of information including text, audio and video files.

# Appendix A

## Data Elements and Term Definitions

# A1. List of key questions and indicators, indexed to data elements

[DATA ELEMENTS ARE LISTED IN APPENDIX A2, BEGINNING ON PAGE 125.]

CHAPTER 1: TECHNOLOGY PLANNING AND POLICIES

| **TP1. Are there technology policies?** |
|---|
| Policy development process exists; technology policies are approved or in process; policies are in place.<br>Data elements: TP001-TP005 |
| **TP2. Is there a technology plan?** |
| Pre-planning phase completed or underway; major planning components are present; technology plan is approved.<br>Data elements: TP006-TP009 |
| Percentage of total technology plan budget that has funds committed to its support; percentage of federal funding, state funding; funding through other (local or private) sources.<br>Data elements: TP010-TP012 |
| **TP3. Is the plan being implemented?** |
| Status of each major plan component; plan schedule and benchmarks being met.<br>Data elements: TP013, TP014 |
| **TP4. Is the plan being evaluated?** |
| Review cycle is implemented.<br>Data element: TP015 |
| Review cycle includes accountability components.<br>Data element: TP016 |
| There is a provision for revision of the plan.<br>Data element: TP017 |
| The review is detailed in a published report, available to the school and community.<br>Data element: TP018 |
| The technology plan has been modified on the basis of the most recent evaluation review.<br>Data element: TP019 |
| The school or district is achieving technology plan goals.<br>Data element: TP020 |

**FI1. How does your school district compare in technology expenditures with others in your state?**

Expenditure comparisons for equipment (administrative, instructional): as a percentage of total technology expenditures; average per student, per teacher or administrative staff member, per building.
Data elements: GC004, GC006, GC010, GC011, FI001, FI002

Comparisons for expenditures for connectivity and infrastructure upgrades: per student, per building.
Data element: GC004, GC011, FI003

Comparisons for expenditures for applications (software) (administrative, instructional): as a percentage of total technology expenditures; average per student, per teacher or administrative staff member, per building.
Data elements: GC004, GC006, GC010, GC011, FI004, FI005

Comparisons for expenditures for maintenance and support (personnel, non-personnel): as a percentage of total technology expenditures; average per student, per computer, per building.
Data element: GC004, GC006, GC010, GC011, EI001, EI068, FI006, FI007

Comparisons for professional development (administrative, instructional): as a percentage of total technology expenditures; average per student, per administrative staff member or teacher, per building.
Data elements: GC004, GC006, GC010, GC011, FI008, FI009

**FI2. How much was spent in the past academic year for instructional and administrative equipment purchases?**

Expenditures for (instructional, administrative) equipment: as a percentage of the amount originally budgeted; average per student, per teacher or administrative staff member, per building.
Data elements: GC004, GC006, GC010, GC011, FI010, FI011

**FI3. How much was spent for instructional and administrative applications and software?**

Expenditures for (instructional, administrative) applications (software): as a percentage of total expenditures for instructional materials; as a percentage of the amount originally budgeted; average per student, per teacher, per building.
Data elements: GC004, GC006, GC010, GC011, FI012, FI013

**FI4. How much was spent for maintenance and support?**

Expenditures for (technology support personnel, maintenance agreements and contracts, replacement components) as a percentage of the amounts originally budgeted; per student, per building.
Data elements: GC004, GC011, FI014-FI016

**FI5. How much was spent for instructional and administrative professional development?**

Expenditures for (instructional, administrative) professional development as a percentage of amounts originally budgeted; average per student, per teacher or administrative staff member, per building.
Data elements: GC004, GC006, GC010, GC011, FI017, FI018

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CHAPTER 2: FINANCE *(continued)*

Expenditures for (training materials, external consultants, presentations and workshops) as a percentage of total expenditures for (instructional, administrative) professional development.
Data elements: FI019-FI024

**FI6. How much was spent for connectivity and infrastructure?**

Average expenditures for connectivity and infrastructure per student, per teacher, per building.
Data elements: GC004, GC006, GC011, FI025

Expenditures for (telecommunications and Internet access, networking maintenance agreements and contracts, system or network monitoring software): as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure.
Data elements: FI026-FI028

## CHAPTER 3. EQUIPMENT AND INFRASTRUCTURE

**EI1. Is equipment present in instructional settings?**

Percentage of instructional settings with one or more (up-to-date computers, multimedia computers, computers connected to the Internet).
Data elements: GC001, EI002, EI007, EI014

Average number of (up-to-date computers, multimedia computers, computers connected to the Internet) per instructional setting.
Data elements: GC001, EI001, EI006, EI013

Two-way videoconferencing capability: availability, percentage of instructional settings with equipment.
Data elements: GC001, EI022, EI023

Graphing calculators: availability, percentage of instructional settings with equipment, average number of students per graphing calculator.
Data elements: GC001, EI024-EI026

Percentage of instructional settings with external input devices (such as DVD players or videocassette recorders).
Data elements: GC001, EI027-EI029

Percentage of instructional settings with broadcast video receivers.
Data elements: GC001, EI030-EI032

Percentage of instructional settings with projection devices.
Data elements: GC001, EI033-EI038

Percentage of instructional settings with dedicated printer.
Data elements: GC001, EI039

**EI2. Is equipment available for use by students?**

Average number of students per (up-to-date computer, multimedia computer, computer connected to the Internet) dedicated to student use in instructional settings.
Data elements: EI041, EI042, EI045-EI048

## CHAPTER 3. EQUIPMENT AND INFRASTRUCTURE *(continued)*

Percentage of students (with regular access to multimedia computers, with regular access to computers connected to the Internet, with access only in computer laboratories, without regular access to computers).
Data elements: GC004, EI043-EI045, EI047

**EI3. Is equipment available for use by teachers?**

Percentage of teaching staff with access to a computer for instructional use, by location of access (at school, at home).
Data elements: GC005, EI049, EI050

Percentage of teaching staff with their own (dedicated) computer at school (by computer capabilities, type, Internet access, age).
Data elements: GC005, EI051-EI056, EI058-EI060

Teaching staff are allowed to take school-provided computers to their homes outside of school hours.
Data element: EI057

**EI4. Is equipment available for use by administrators and support staff?**

Percentage of administrative or support staff with a dedicated, up-to-date computer (by computer capabilities, age, Internet access).
Data elements: GC007, EI061-EI068

**EI5. Does the infrastructure have the capacity to support the school's technology needs?**

Percentage of instructional settings with one or more up-to-date computers connected to a network.
Data elements: GC001, EI012

Ratio of staff to dedicated computers connected to a network (instructional, administrative and support).
Data elements: GC005, GC007, EI055, EI063

Availability of bandwidth (to building).
Data element: EI021

## CHAPTER 4: TECHNOLOGY APPLICATIONS

**TA1. Do the school or district's instructional applications support teaching and learning standards across the curriculum?**

Existence and current status of software alignment plan (most likely at district or state level; may be for all subjects or for a specific curriculum area or grade).
Data element: TA001

Number of approved instructional and teacher-support applications in regular use (by subject area, grade and type).
Data element: TA004

Percentage of instructional applications aligned with one or more learning standards.
Data element: TA004, TA005

## CHAPTER 4: TECHNOLOGY APPLICATIONS *(continued)*

**TA2. Is there software support for technology tool skill development?**

Count of applications, by type, in use in instructional settings in the school or district that support tool skill development.
Data element: TA006

**TA3. Does the school/district use technology applications to improve communication?**

E-mail applications by type (School or district-wide, non-Internet; Internet-based; none).
Data element: TA007

E-mail: Percentage of (teachers, students) with active accounts.
Data elements: TA008, TA009

Existence of active district/school web site; usage; teacher participation.
Data elements: TA010-TA013

Use of Internet telephony ("voice over IP," voIP) in the school or district.
Data element: TA014

**TA4. Does the school/district have appropriate software and systems to support primary administrative functions?**

Availability of applications to support core administrative activities, by activity type.
Data element: TA015

Decision support tools are available to administrators, teachers, curriculum groups, parents and public; availability by information category.
Data elements: TA016-TA019

Availability and regular use of applications that support school/district Security and Acceptable Use Policies; by application type.
Data elements: TA020-TA021

**TA5. Are the applications in use evaluated for effectiveness?**

Existence of software evaluation plan; evaluation ratings by software category.
Data elements: TA022, TA023

## CHAPTER 5: MAINTENANCE AND SUPPORT

**MS1. Are resources and processes in place to maintain school technology?**

Preventive maintenance schedule established; backup and disaster recovery procedures in place.
Data elements: MS001-MS004, MS020

Number and type of maintenance incidents, average downtime, average number of user calls to help desk, average time to repair (per workstation, per server) in the most recent academic year.
Data elements: MS005-MS012, EI001, EI068, EI069

Help desk, FAQ support (to help desk, to users), access to manuals.
Data elements: MS013-MS016

Replacement/upgrade schedule established (hardware and software).
Data element: MS017

## CHAPTER 5: MAINTENANCE AND SUPPORT *(continued)*

Diagnostic software available (where appropriate); repair tools and parts available.
Data elements: MS018, MS019

**MS2. Are personnel available to provide technical support?**

Number of dedicated persons assigned to technical support (building, district level) and total FTE hours assigned to technical support (by primary area of responsibility).
Data elements: MS021-MS023

Average hours of technical support by source (building, district level).
Data element: MS024

Number and ratio of calls and incidents handled by FTE position; ratio of (workstations, servers, users) to technical support staff.
Data elements: MS025-MS028

## CHAPTER 6: PROFESSIONAL DEVELOPMENT

**PD1. What technology-related training and/or professional development do staff receive?**

Hours of training/professional development, per staff FTE (instructional, administrative and support).
Data elements: GC006, GC010, PD003, PD007

Proportion of technology-related professional development to total professional development (instructional, administrative and support)
Data elements: PD003, PD004, PD007, PD008

Percentage of (teaching, administrative and support) staff with at least the minimum required number of hours of technology-related professional development.
Data elements: GC005, GC007, PD004, PD008, PD009, PD010

**PD2. What are the goals, methods, incentives, and content of technology-related training and/or professional development for staff?**

Existence of a written goal statement for technology-related professional development for staff (teaching, administrative and support); technology-related content areas covered in training and/or professional development for staff in the past academic year.
Data elements: PD011, PD012, PD015, PD016

Percentage of total hours of technology-related training and/or professional development provided through various means and using various incentives.
Data elements: PD013, PD 014, PD017, PD018

**PD3. How are training and/or professional development for staff evaluated?**

Administrators, technology coordinators or curriculum supervisors/department heads receive training in evaluating staff technology proficiency or extent of integration of technology into the curriculum (teaching, administrative and support); existence of evaluation criteria for effects of training and/or professional development.
Data elements: PD019-PD022

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## CHAPTER 7: TECHNOLOGY INTEGRATION

**TI1. Are teachers proficient in the use of technology in the teaching/learning environment?**

Percentage of teachers achieving acceptable performance on standards-based performance profiles of user skills.
Data elements: GC005, TI001

**TI2. Are students proficient in the use of technology in the teaching/learning environment?**

Count of courses that include training or instruction in technology tool skills in their contents.
Data element: TI002

Percentage of students who perform at or above grade-level-specific performance levels on standards-based profiles of user skills; percentage of students demonstrating competency on the Basic Skills, Critical Literacies, and Construction Skills scales.
Data elements: GC004, TI003-TI006

Percentage of students using computer-based assistive or adaptive technologies to compensate for disabilities or limitations; percentage of instructional settings with available computer-based assistive or adaptive technologies.
Data elements: GC001, GC004, TI007, TI008

**TI3. Are administrators and support staff proficient in the use of technology in support of school management?**

Percentage of administrators achieving acceptable performance on standards-based performance profiles of user skills; percentage of support staff achieving acceptable technology proficiency.
Data elements: GC008, GC009, TI009, TI010

Percentage of administrators and support staff using computer-based technologies on a variety of administrative tasks.
Data elements: GC008, GC009, TI011, TI012

**TI4. Is technology integrated into the teaching/learning environment?**

Percentage of teachers and students using computer-based technologies on a variety of instructional and instruction-related tasks.
Data elements: GC004, GC005, TI013, TI014

Count of courses offered through both external (state or regional) and internal (district-wide) distance education.
Data element: TI015

**TI5. Are technology proficiencies and measures incorporated into teaching and learning standards?**

Inclusion of technology in standards (in general or subject-area for students, for teachers).
Data elements: TI016-TI019

| |
|---|
| **TI6. Are technology proficiencies and measures incorporated into student assessment?** |
| Inclusion of technology-related items in student assessments.<br>Data element: TI020 |
| Count of student assessments that are technology-based.<br>Data element: TI021 |
| **TI7. Is technology incorporated into administrative processes?** |
| Extent of integration in administrative tasks for a number of administrative processes.<br>Data elements: TI022-TI044 |
| Percentage of teachers using computer-based technologies on instruction-related administrative tasks.<br>Data elements: GC005, TI045 |
| **TI8. Is technology proficiency integrated into the evaluation of instructional and administrative staff?** |
| Inclusion of technology-related items in evaluation (teacher, administrator and support staff).<br>Data elements: TI046-TI048 |

## A2. List of data elements, by chapter and key question/indicator within chapter

### *Data Element Category Codes*

| | |
|---|---|
| GC | General Classification |
| TP | Technology Planning and Policies |
| FI | Finance |
| EI | Equipment and Infrastructure |
| TA | Technology Applications |
| MS | Maintenance and Support |
| PD | Professional Development |
| TI | Technology Integration |

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### *GC – General Classification*

These data elements apply generally to more than one chapter of the handbook, and so are not keyed to one particular chapter. Data element definitions will be matched to those in two other Forum publications, the *Staff Data Handbook* (NCES 2001–305) and the *Student Data Handbook* (NCES 2000–343r), where possible.

**GC001** Total number of instructional settings in the school building.

**Instructional setting:** Includes both regular classrooms and computer laboratories.

**GC002** Total number of classrooms.

**GC003** Total number of computer laboratories.

**GC004** Total number of students enrolled.

**GC005** Total number of teaching staff. Includes teachers with regular assignments as well as long-term substitutes; does not include short-term substitute teachers. An alternative data element would be GC006.

**GC006** Full-time-equivalent (FTE) number of teaching staff. Sum of FTE values for all teachers with regular assignments as well as long-term substitutes; does not include short-term substitute teachers. An alternative data element would be GC005.

**GC007** Total number of administrative or support staff.

**GC008** Total number of administrators.

**GC009** Total number of administrative support staff.

**GC010** Full-time-equivalent (FTE) number of administrative and support staff.

**GC011** Total number of schools.

## *Chapter 1: Technology Planning and Policies*

### *TP1. Are there technology policies?*

**TP001** Technology policies are in place and being implemented.

**TP002** Types of technology policies that are in place.

**Types of technology-related policies:** acceptable-use (or appropriate-use) policies (AUPs); restrictions on access to student records; technology security policies; policies regarding acceptance of commercial advertising on school web sites; policies regarding acquisition, maintenance or disposal of school equipment or applications; policies regarding acceptance of donated equipment and software; policies regarding community or after-school access to school or district technology resources.

**TP003** Technology policies are in process of approval.

**TP004** A technology policy development process is ongoing.

**TP005** Types of technology policies that are in process or under development.

***TP2. Is there a technology plan?***

**TP006** Pre-planning phase stages that have been accomplished.

**TP007** Pre-planning phase stage(s) that are under way.

**Possible list of stages for the pre-planning phase** (see discussion for key question TP2 in chapter 2): assessment of current technology status; current and future needs assessment; determination of planning team composition; identification and recruitment of planning team members and leadership.

**TP008** Major technology plan components are in place.

**Major plan components** can include:

- review of technology status, needs assessment and other pre-planning products
- vision/goal statements
- equity issues
- instructional uses of technology
- student technology standards
- staff technology standards
- integration into core curriculum
- pilot program and action research
- management uses of technology
- student information systems
- infrastructure and support for infrastructure, including such facilities-related needs as air conditioning/cooling and asbestos abatement
- review of current "state of the art" for options in design of infrastructure
- capabilities of hardware and software, projections of "next generation" capabilities and features
- long-range goals
- inventory control issues, such as maintenance and replacement cycle

- budget projects for initial installation, hardware and software
- staff training programs
- benchmarking standards
- quality control components
- security planning

**TP009** Technology plan has been approved for implementation.

**TP010** Total amount committed for implementation of the technology plan in the current budget year.

**TP011** Total amount required for full implementation of the technology plan in the current budget year.

**TP012** Amount budgeted for technology plan in the current budget year, by source of funds (federal, state, local, private).

***TP3. Is the plan being implemented?***

**TP013** Status of major plan components (not yet underway; underway and on schedule; underway and behind schedule; completed).

Note: For list of possible major plan components, see TP06.

**TP014** Schedule and benchmarks for technology plan are being met.

***TP4. Is the plan being evaluated?***

**TP015** Review cycle is implemented.

**TP016** Review cycle includes accountability components.

**Review cycle components** include accountability measures, such as identification of indicators during pre-planning to maintain records of progress; technical performance; student performance; community support; implementation benchmarks; budget analyses; utilization records; evaluation components, and progress measures.

**TP017** There is a provision for revision of the plan.

**TP018** The review is detailed in a published report, available to the school and community.

**TP019** The technology plan has been modified on the basis of the most recent evaluation review.

**TP020** The school or district is achieving technology plan goals.

## Chapter 2: Finance

Note: All data elements in this chapter are based on annual expenditures for the most recent available academic year. More exact specification of these data elements will depend on data elements and indicators under development by the Finance Task Force.

***FI1. How does your school district compare in technology expenditures with others in your state?***

Note: All data elements for this key question assume that similar data exist as statewide averages or as data for other districts.

**FI001** Expenditure comparisons for administrative equipment as a percentage of total technology expenditures; average per student, per administrative staff member, per building.

**FI002** Expenditure comparisons for instructional equipment as a percentage of total technology expenditures; average per student, per teacher, per building.

**FI003** Expenditure comparisons for connectivity and infrastructure upgrades: per student, per building.

**FI004** Comparisons for expenditures for administrative applications (software): as a percentage of total technology expenditures; average per student, per building.

**FI005** Comparisons for expenditures for instructional applications (software): as a percentage of total technology expenditures; average per student, per teacher, per building.

**FI006** Comparisons for expenditures for maintenance and support personnel: as a percentage of total technology expenditures; average per student, per computer, per building.

**FI007** Comparisons for expenditures for maintenance and support (non-personnel): as a percentage of total technology expenditures; average per student, per computer, per building.

**FI008** Comparisons for expenditures for administrative professional development: as a percentage of total technology expenditures; average per student, per administrative staff member, per building.

**FI009** Comparisons for expenditures for instructional professional development: as a percentage of total technology expenditures; average per student, per administrative staff member, per teacher, per building.

***FI2. How much was spent in the past academic year for instructional and administrative equipment purchases?***

**FI010** Expenditures for administrative equipment: as a percentage of the amount originally budgeted; average per student, per building.

**FI011** Expenditures for instructional equipment: as a percentage of the amount originally budgeted; average per student, per teacher, per building.

***FI3. How much was spent for instructional and administrative applications and software?***

**FI012** Expenditures for administrative applications (software): as a percentage of total expenditures for instructional materials; as a percentage of the amount originally budgeted; average per student, per administrative staff member, per building.

**FI013** Expenditures for instructional applications (software): as a percentage of total expenditures for instructional materials; as a percentage of the amount originally budgeted; average per student, per teacher, per building.

***FI4. How much was spent for maintenance and support?***

**FI014** Expenditures for technology support personnel: as a percentage of the amounts originally budgeted; average per student, per building.

**FI015** Expenditures for maintenance agreements and contracts: as a percentage of the amounts originally budgeted; average per student, per building.

**FI016** Expenditures for replacement and upgrade components: as a percentage of the amounts originally budgeted; average per student, per building.

***FI5. How much was spent for instructional and administrative professional development?***

**FI017** Expenditures for administrative professional development: as a percentage of amounts originally budgeted, average per student, per administrative staff member, per building.

**FI018** Expenditures for instructional professional development: as a percentage of amounts originally budgeted, average per student, per teacher, per building.

**FI019** Expenditures for training materials for administrative professional development as a percentage of total expenditures for administrative professional development.

**FI020** Expenditures for training materials for instructional professional development as a percentage of total expenditures for instructional professional development.

**FI021** Expenditures for external consultants for administrative professional development as a percentage of total expenditures for administrative professional development.

**FI022** Expenditures for external consultants for instructional professional development as a percentage of total expenditures for instructional professional development.

**FI023** Expenditures for presentations and workshops for administrative professional development as a percentage of total expenditures for administrative professional development.

**FI024** Expenditures for presentations and workshops for instructional professional development as a percentage of total expenditures for instructional professional development.

***FI6. How much was spent for connectivity and infrastructure?***

**FI025** Average expenditures for connectivity and infrastructure per student, per teacher, per building.

**FI026** Expenditures for telecommunications and Internet access: as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure.

**FI027** Expenditures for networking maintenance agreements and contracts: as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure.

**FI028** Expenditures for system or network monitoring software: as a percentage of amount budgeted, as a percentage of total expenditures for connectivity and infrastructure.

## *Chapter 3: Equipment and Infrastructure*

***EI1. Is equipment present in instructional settings?***

**EI001** Total number of up-to-date computers in instructional settings.

> **Up-to-date:** Computers purchased in the five years prior to data collection. Example rating for computer age groupings: 0-12 months between purchase and data collection; 13-36 months between purchase and data collection; and over 37 months.

This count should include all computers dedicated to student and teacher use.

**EI002** Total number of instructional settings with one or more up-to-date computers.

**EI003** Total number of computers with 0-12 months between purchase and data collection.

**EI004** Total number of computers with 13-36 months between purchase and data collection.

**EI005** Total number of computers with 37-60 months between purchase and data collection.

**EI006** Total number of multimedia computers in instructional settings.

> **Multimedia computer:** Refers to computers capable of running Windows 95 or Macintosh OS8.0 or later operating systems, with chipsets such as Pentium (200 MHz) or PowerPC 200 MHz or Imac G3 or better, with at least 64MB of random-access memory (RAM), with CD-ROM or DVD player, and with a sound card, manufactured in the five years prior to data collection.

**EI007** Total number of instructional settings with one or more multimedia computers.

**EI008** Total number of multimedia computers with 0-12 months between manufacture and data collection.

**EI009** Total number of multimedia computers with 13-36 months between manufacture and data collection.

**EI010** Total number of multimedia computers with 37-60 months between manufacture and data collection.

**EI011** Total number of up-to-date computers connected to a local-area network (building-level LAN) or wide-area network (district-level WAN) in instructional settings.

**EI012** Total number of instructional settings with one or more up-to-date computers connected to a local-area network (building-level LAN) or wide-area network (district-level WAN).

**EI013** Total number of up-to-date computers connected to the Internet in instructional settings.

**EI014** Total number of instructional settings with one or more up-to-date computers connected to the Internet.

**EI015** Total number of instructional settings with one or more up-to-date computers connected to the Internet by dial-up via modem.

> **Connection types:** Refers to the kind of link between a computer and external networking resources. Example of connection types: dial-up via modem; wired LAN and router; wireless LAN and router; cable modem; satellite/modem hybrid link; full satellite (two-way) link.

**EI016** Total number of instructional settings with one or more up-to-date computers connected to the Internet by wired LAN and router.

**EI017** Total number of instructional settings with one or more up-to-date computers connected to the Internet by wireless LAN and router.

**EI018** Total number of instructional settings with one or more up-to-date computers connected to the Internet by cable modem.

**EI019** Total number of instructional settings with one or more up-to-date computers connected to the Internet by satellite/modem hybrid link.

**EI020** Total number of instructional settings with one or more up-to-date computers connected to the Internet by full satellite (two-way) link.

**EI021** Amount of (shared) bandwidth for Internet access in the building.

> **Bandwidth:** Example ratings for bandwidth amount: 33.6 KBPS or under; 56 KBPS; 128 KBPS; 256 KBPS; 512 KBPS; 768 KBPS (.5 T1); 1.544 MBPS (T1); Ethernet; DS(1) or higher.

**EI022** Availability of two-way videoconferencing capability, or other distance education technology, in the school building (by capability type).

> **Videoconferencing/distance education equipment capability:** Example of types: dedicated room or facility; in one or more classrooms, no capability in building.

**EI023** Total number of instructional settings with two-way videoconferencing capability.

**EI024** Total number of courses taught in the school with regular use of graphing calculators.

**EI025** Total number of instructional settings in which graphing calculators are regularly used.

**EI026** Total number of students in courses taught with regular use of graphing calculators.

**EI027** Total number of instructional settings with dedicated external input devices.

> **External input devices:** Example of dedicated external input device types: videocassette recorder, digital video disk.

**EI028** Total number of instructional settings with dedicated videocassette recorder.

**EI029** Total number of instructional settings with dedicated digital video disk player.

**EI030** Total number of instructional settings with broadcast video receiving equipment (cable-connected monitors), by type of device.

> **Broadcast video receivers**: Example of broadcast video receiving device types: closed-circuit building-level cable system, external cable system.

**EI031** Total number of instructional settings with closed-circuit cable access.

**EI032** Total number of instructional settings with access to an external cable system.

**EI033** Total number of instructional settings with projection device, by type of device.

> **Projection devices**: Example of projection device types: large monitor, overhead opaque projector, computer projector or electronic whiteboard, overhead transparency projector.

**EI034** Total number of instructional settings with one or more dedicated large screen monitors.

> **Large-screen** monitors: Monitors with diagonal measurements of 27" or larger.

**EI035** Total number of instructional settings with an overhead opaque projector.

**EI036** Total number of instructional settings with a computer projector.

**EI037** Total number of instructional settings with an electronic whiteboard.

**EI038** Total number of instructional settings with an overhead transparency projector.

**EI039** Total number of instructional settings with one or more dedicated printers.

**EI040** Total number of printers dedicated to instructional use in the school building.

***EI2. Is equipment available for use by students?***

**EI041** Total number of students in instructional settings with one or more up-to-date computers dedicated to student use.

**EI042** Total number of up-to-date computers dedicated to student use in instructional settings.

**EI043** Total number of students in instructional settings without a computer (and no access to computer laboratories; see EI044).

**EI044** Total number of students with access to computers only in computer laboratories (i.e., outside of regular classroom setting).

**EI045** Total number of students in instructional settings with one or more multimedia computers dedicated to student use.

**EI046** Total number of multimedia computers dedicated to student use in institutional settings.

**EI047** Total number of students in instructional settings with one or more Internet-connected computers dedicated to student use.

**EI048** Total number of students in instructional settings with one or more Internet-connected computers dedicated to student use.

***EI3. Is equipment available for use by teachers?***

**EI049** Total number of teachers with regular access to a computer at home.

**EI050** Total number of teachers with regular access to a computer at school.

**EI051** Total number of teachers with an up-to-date laptop computer dedicated to their use at school.

> **Laptop computer**: Portable personal computer with a battery and a monitor, suitable for carrying and using detached from a desk or power supply; see also "Desktop computer."

**EI052** Total number of teachers with an up-to-date desktop computer dedicated to their use at school.

> **Desktop computer**: Personal computer with an attached monitor, keyboard, and mouse, primarily for individual use and not generally detachable; see also "Laptop computer."

**EI053** Total number of teachers with an up-to-date computer dedicated to their use at school.

**EI054** Total number of teachers with a multimedia computer dedicated to their use at school.

**EI055** Total number of teachers with a dedicated up-to-date computer connected to a local-area network (building-level LAN) or wide-area network (district-level WAN) in instructional settings.

**EI056** Total number of teachers with a computer with Internet access dedicated to their use at school.

**EI057** School policy allows (or encourages) teachers to take school-provided computers to their homes.

**EI058** Total number of teachers with a computer dedicated to their use at school with 0-12 months between purchase and data collection.

**EI059** Total number of teachers with an up-to-date computer dedicated to their use at school with 13-36 months between purchase and data collection.

**EI060** Total number of teachers with an up-to-date computer dedicated to their use at school with 37 or more months between purchase and data collection.

***EI4. Is equipment available for use by administrators and support staff?***

**EI061** Total number of administrative or support staff with an up-to-date computer dedicated to their use at school.

**EI062** Total number of administrative or support staff with a multimedia computer dedicated to their use at school.

**EI063** Total number of administrative or support staff with an up-to-date computer connected to a local-area network (building-level LAN) or wide-area network (district-level WAN) in the school.

**EI064** Total number of administrative or support staff with a computer with Internet access dedicated to their use at school.

**EI065** Total number of administrative or support staff with a computer dedicated to their use at school with 0-12 months between purchase and data collection.

**EI066** Total number of administrative or support staff with an up-to-date computer dedicated to their use at school with 13-36 months between purchase and data collection.

**EI067** Total number of administrative or support staff with an up-to-date computer dedicated to their use at school with 37 or more months between purchase and data collection.

**EI068** Total number of up-to-date computers in administrative settings.

**EI069** Total number of up-to-date servers.

> Note: This number should include both machines dedicated to instructional and to administrative use.

***EI5. Does the infrastructure have the capacity to support the school's technology needs?***

There are no new data elements introduced for the indicators for this key question.

## *Chapter 4: Technology Applications*

***TA1. Do the school or district's instructional applications support teaching and learning standards across the curriculum?***

**TA001** Existence and current status of software alignment plan (most likely at district or state level; plan may be for all subjects or for a specific curriculum area or grade span).

> Note: There may be multiple data elements, depending on whether more than one software standard alignment plan has been adopted.
>
> **Categories for existence and current status of software/applications alignment plan**: 0=no alignment plan exists; 1=an alignment plan is being developed; 2=an alignment plan has been approved; 3=an alignment plan is approved and is being implemented.

**TA002** Alignment rating (for each application).

> Note: There may be as many data elements as there are applications with alignment ratings.
>
> **Alignment rating** (for a single software/applications package; may be for alignment with standards for all subjects, or for a specific curriculum area or grade): 0=no alignment to standards exists for this application; 1=a weak alignment to standards exists for this application; 2=this application is somewhat aligned to standards; 3=a strong alignment to standards exists for this application; 4=this application is fully aligned to standards. [Note: Judgment about relative strength of alignment to standards might be in terms of the extent of fit between software goals and one or more standards, or in terms of the number of standards addressed by a software package or application; also relevant could be the credibility of the rating organization.]

**TA003** Alignment measure (for each standard).

Note: There may be as many data elements as there are learning standards for different subjects, curriculum areas or grade spans.

**Alignment measure** (for a single teaching and learning standard; may be for all subjects, or for a specific curriculum area or grade): 0=None of the applications in use in the school/district have been rated as fully aligned to a given learning standard; 1=One application has been rated as fully aligned to a learning standard; 2=More than one application has been rated as fully aligned to a learning standard.

**TA004** Number of approved instructional and teacher-support applications in regular use (by subject area, grade or grade span and type).

**Instructional application types**: instructional process support (see also "teacher-support instructional applications," immediately below); learning support (practice drills; problem solving; data analysis; simulation/demonstration; research; distance learning); assessment.

**Teacher-support instructional application types**: software or applications specifically designed to support teachers in instructional processes. Examples include attendance software; grading applications; testing systems; student work or portfolio systems; lesson planning software.

**TA005** Percentage of instructional applications aligned with one or more learning standards.

Note: Data element can be measured as the number of applications with ratings of 3 or 4 (see **TA002 Alignment rating**, above) divided by the total number of instructional applications and converted to a percentage. May be for alignment with standards for all subjects, or for a specific curriculum area or grade.

***TA2. Is there software support for technology tool skill development?***

**TA006** Count of approved applications, by type, in use in instructional settings in the school or district that support tool skill development.

**Example categories for application types that support tool skill development in instructional settings**: word processors; spreadsheets; database software; desktop publishing; process writing software; keyboarding training software; telecommunications; web browsers and search engines; web authoring; presentation development software; programming tools, including compilers and interpreters.

***TA3. Does the school/district use technology applications to improve communication?***

**TA007** Existence and type of electronic mail service.

**E-mail type categories**: School or district-wide, non-Internet; Internet-based; none.

**TA008** E-mail: Percentage of teachers with active electronic mail accounts.

**Active account** (electronic mail): At least one message sent in the current academic year.

**TA009** Percentage of students with active electronic mail accounts.

**TA010** Existence of active district/school web site.

**Active web site/page**: At least one update in the past 90 days.

**TA011** Extent of school web site usage.

**School/District web site usage**: Count of user sessions in a month, converted to a daily average.

**TA012** Percentage of classrooms with active web pages.

**TA013** Percentage of teachers with active web pages.

**TA014** Use of Internet telephony ("voice over IP," voIP) in the school or district.

***TA4. Does the school/district have appropriate software and systems to support primary administrative functions?***

**TA015** Availability of applications to support core administrative activities, by activity type.

**Software/Application types to support core administrative activities**: Capital improvements (building and grounds); financial (accounting, budgeting, payroll, human resources); food services; inventory control; library services (cataloguing, circulation); network security (firewall, filtering, secure data transmission, Acceptable Use Policy enforcement); office applications; student materials (purchasing, inventory); student records management (attendance, assessment, grading); teacher records management (attendance, assessment, certification); transportation; other software and applications.

**TA016** Decision support tools are available to administrators.

**TA017** Decision support tools are available to teachers and curriculum groups.

**TA018** Decision support tools are available to parents and the public.

**TA019** Availability of decision support tools, by information category.

**TA020** Availability of applications that support school/district Security and Acceptable Use Policies.

**TA021** Applications in regular use that support the school/district Security and Acceptable Use Policies, by application type.

> Note: For application types, see example application types for tool skill development, TA006.

### *TA5. Are the applications in use evaluated for effectiveness?*

**TA022** A school or district software evaluation plan exists.

**TA023** Software/application evaluation ratings, by software category.

> Note: This will primarily apply to instructional applications. Example software/applications category types are given above in **TA004, Number of approved instructional and teacher-support applications**.

## *Chapter 5: Maintenance and Support*

### *MS1. Are resources and processes in place to maintain school technology?*

**MS001** A preventive maintenance schedule is maintained.

**MS002** Backup procedures are in place.

**MS003** A disaster recovery plan and associated procedures are in place.

**MS004** A preventive maintenance checklist is provided to users with dedicated machines.

**MS005** Total number of workstation-related maintenance incidents in the most recent academic year, by cause category.

> **Cause of maintenance incident, categories**: human error; software failure; hardware failure; network switching device or router failure; network cable or wiring failure; wireless system failure.

**MS006** Total number of workstation-related maintenance incidents in the most recent academic year, by major location.

> **Major location categories**: in classroom; in laboratory or media center; in teacher lounge or teacher offices; in administrative offices.

**MS007** Total number of downtime hours for workstation-related maintenance incidents in the most recent academic year, by cause category.

> **Downtime**: the amount of time a machine or system spends in an inoperable state; alternatively, the amount of time between a call for maintenance and the resolution of the problem.

**MS008** Total number of calls to help desk or technology support services for workstation-related maintenance incidents in the most recent academic year, by cause category.

**MS009** Total number of downtime hours for workstation-related maintenance incidents in the most recent academic year, by major location.

**MS010** Total number of calls to help desk or technology support services for workstation-related maintenance incidents in the most recent academic year, by major location.

**MS011** Average time elapsed between user call to help desk and initial response call, for workstation-related maintenance incidents in the most recent academic year.

**MS012** Average time elapsed between initial response call and notification to user of problem resolution, for workstation-related maintenance incidents in the most recent academic year.

**MS013** Help desk or technology support services are provided to users.

**MS014** FAQ (frequently-asked-question) support is provided to technology support service personnel.

**MS015** FAQ support is provided to users.

**MS016** Access to software and systems manuals is provided for users.

> **Manual location categories**: at workstation; in classroom or laboratory; in library or other building central location; at district office or technology support office; online through local resources; online through vendor or other remote resource.

**MS017** Replacement and upgrade schedules are established for both hardware and software.

**MS018** Diagnostic software for network and software assessment is in place.

**MS019** Repair facilities and spare parts are available for most hardware problems.

**MS020** A system for managing consumable supplies is in place.

***MS2. Are personnel available to provide technical support?***

**MS021** Number of dedicated persons assigned to technical support (at building, district levels).

**MS022** Total FTE hours assigned to technical support (at building, district levels).

Note: Includes all dedicated and part-time positions.

**Full-time-equivalent (FTE) support staff hours**: total number of hours committed by support staff (equals the sum of FTE levels for each support staff person).

**MS023** Total FTE hours assigned to technical support, by primary area of responsibility.

**Primary area of responsibility, categories**: part-time teacher; full-time teacher; part-time administrator; full-time administrator; student; outsource contractor; volunteer; school staff technology support specialist; district staff technology support specialist.

**MS024** Average hours of technical support, by source (at building, district levels).

**Source of support, categories**: school or district staff; outside volunteer resource; outside paid resource.

**MS025** Number of help desk or technical service support calls handled per FTE position, per hour of technical support.

**MS026** Number of maintenance incidents per FTE position, per hour of technical support.

**MS027** Number of (workstations, servers) per FTE technical support staff.

**MS028** Number of users (teachers, students, administrators and support staff) per FTE technical support staff.

## Chapter 6: Professional Development

***PD1. What technology-related training and/or professional development do staff receive?***

**PD001** Total hours of professional development during the academic year for each teaching staff member.

Note: In what follows, professional development and training are considered the same and the term "professional development" is used to include both.

For this data element, technology coordinators or professional development coordinators are asked to estimate what proportion of the time spent on a given event was spent in technology-related professional development; given that technology training seldom occurs outside of an educational context, there may be no other way to estimate the extent of technology-related professional development.

**PD002** Total estimated hours of technology-related professional development during the academic year for each teaching staff member.

**PD003** Total hours of professional development during the academic year for all teaching staff.

**PD004** Total estimated hours of technology-related professional development during the academic year for all teaching staff.

**PD005** Total hours of professional development during the academic year for each administrative and support staff member.

**PD006** Total estimated hours of technology-related professional development during the academic year for each administrative and support staff member.

**PD007** Total hours of professional development during the academic year for all administrative and support staff.

**PD008** Total estimated hours of technology-related professional development during the academic year for all administrative and support staff.

**PD009** Minimum required (district or state) number of hours of technology-related professional development for teaching staff.

Note: To make comparison possible, the requirement should be expressed in "seat time."

**PD010** Minimum required (district or state) number of hours of technology-related professional development for administrative and support staff.

***PD2. What are the goals, methods, incentives, and content of technology-related training and/or professional development for staff?***

**PD011** A written goal statement for technology-related professional development for teaching staff exists.

**PD012** Technology-related content areas covered in training and/or professional development for teaching staff in the most recent academic year.

**Academic year**: a period that begins on the first day of classes and ends on the last day of classes, usually consisting of two semesters or three quarters, and includes a minimum of 30 weeks of instructional time over the course of one calendar year.

**Technology-related content areas**: can include planning and designing technology-supported learning; implementing technology-supported learning; technology tool skills; professional productivity; assessment; social, ethical and legal issues.

**PD013** Number of hours of professional development provided to teaching staff, by various delivery means and event types.

**Delivery means**: web or other online; interactive video or other teleconferencing; satellite or television broadcast; video tape, CD-ROM, DVD; "hands on" workshop; lecture, presentation, meeting; computer-based training. Indicate whether access setting is group or individual.

**Event type**: in-service staff development course offered during the normal workday; pre-service course for teachers or administrators; formal class offered outside of working hours.

**PD014** Number of hours of professional development provided to teaching staff, by type of incentive (if any).

**Incentive categories**: recertification points or credits; salary points; money; certificate of class or course completion; release time; computer or training materials.

**PD015** A written goal statement for technology-related professional development for administrative and support staff exists.

**PD016** Technology-related content areas covered in training and/or professional development for administrative and support staff in the most recent academic year.

**PD017** Number of hours of professional development provided to administrative and support staff, by various delivery means and event types.

**PD018** Number of hours of professional development provided to administrative and support staff, by type of incentive (if any).

***PD3. How are training and/or professional development for staff evaluated?***

**PD019** Administrators, technology coordinators or curriculum supervisors/department heads receive training in evaluating teaching staff technology proficiency or extent of integration of technology into the curriculum.

**PD020** Evaluation criteria exist for effects of training and/or professional development for teaching staff.

**PD021** Administrators or technology coordinators receive training in evaluating administrative and support staff technology proficiency.

**PD022** Evaluation criteria exist for effects of training and/or professional development for administrative and support staff.

## *Chapter 7: Technology Integration*

### *TI1. Are teachers proficient in the use of technology in the teaching/learning environment?*

**TI001** Number of teachers achieving acceptable performance on standards-based performance profiles of user skills.

> Note: See Chapter 7 for discussion of teacher performance standards and their measurement. Self-assessment methods involve self-administered questionnaires; external assessment through portfolio review or observation might employ peers, supervisors, or specialized raters.

### *TI2. Are students proficient in the use of technology in the teaching/learning environment?*

**TI002** Count of courses that include training or instruction in technology tool skills in their contents.

**Technology tool skills** (adapted from ISTE Standards for Basic Endorsement in Educational Computing and Technology Literacy, standard 2.2: Productivity Tools):

- Use advanced features of word processing, desktop publishing, graphics programs and utilities to develop professional products.
- Use spreadsheets for analyzing, organizing and displaying numeric data graphically.
- Design and manipulated databases and generate customized reports.
- Use teacher utility and classroom management tools to design solutions for a specific purpose.
- Identify, select, and integrate video and digital images in varying formats for use in presentation, publications and/or other products.
- Apply specific-purpose electronic devices (such as a graphing calculator, language translator, scientific probeware, or electronic thesaurus) in appropriate content areas.
- Use features of applications that integrate word processing, database, spreadsheet, communication, and other tools.

**TI003** Number of students who perform at or above grade-level-specific performance levels on standards-based profiles.

> Note: See Chapter 7 for discussion of student performance standards and their measurement. Self-assessment methods involve self-administered questionnaires; external assessment through portfolio review or observation might employ teachers or specialized raters.

**TI004** Number of students demonstrating competency at the Basic Skills level.

> Note: Standards for Basic Skills, Critical Literacies, and Construction Skills are found in Swan, Karen, *Nonprint Media and Technology Literacy Standards for K–12 Teaching and Learning*, National Research Center on English Learning & Achievement. See Chapter 7 for discussion of student performance standards and their measurement. Self-assessment methods involve self-administered questionnaires; external assessment through portfolio review or observation might employ teachers or specialized raters.

**TI005** Number of students demonstrating competency at the Critical Literacies level. (See TI004)

**TI006** Number of students demonstrating competency at the Construction Skills level. (See TI004)

**TI007** Number of students using computer-based assistive or adaptive technologies to compensate for disabilities or limitations.

> **Adaptive technologies**: external support that can be used to enhance a person's ability to function within his or her environment, such as advanced voice recognition systems, braille computer displays, and text-to-speech programs. See also "Assistive technologies."
>
> **Assistive technologies**: any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities. See also "Adaptive technologies."

**TI008** Number of instructional settings with computer-based assistive or adaptive technologies available to students.

***TI3. Are administrators and support staff proficient in the use of technology in support of school management?***

**TI009** Number of administrators achieving acceptable performance on standards-based performance profiles.

> Note: See Chapter 7 for discussion of administrator performance standards and their measurement. Self-assessment methods involve self-administered

questionnaires; external assessment through portfolio review or observation might employ peers, supervisors, or specialized raters.

**TI010** Number of administrative support staff achieving acceptable technology proficiency performance levels.

Note: To this point proficiency standards for school administrative support staff are not known. It is possible that such standards might be adapted from similar positions in business settings. See Chapter 7.

**TI011** Number of administrators using computer-based technologies on a variety of administrative tasks.

Note: Administrative task lists can be adapted from the International Society for Technology in Education (ISTE) Technology Standards for School Administrators (TSSA), or from tasks listed under Key Question 7. See Chapter 7.

**TI012** Number of administrative support staff using computer-based technologies on a variety of administrative tasks.

Note: Administrative task lists for support staff are not known to be available. It might be possible to adapt tasks listed under Key Question 7. See Chapter 7.

***TI4. Is technology integrated into the teaching/learning environment?***

**TI013** Number of teachers using computer-based technologies on a variety of instructional and instruction-related tasks.

**Example list of instruction-related tasks for teachers**: accessing information on instructional resources; communicating with colleagues or other professionals; creating instructional materials/tasks or visuals; downloading curriculum materials from the Internet; accessing libraries or resources on-line; participating in collaborative projects with remote classrooms or teachers; publishing instructional materials on the Internet; and communicating with parents.

**TI014** Number of students using computer-based technologies on a variety of instructional and instruction-related tasks.

**Example list of instruction-related tasks for students**: gathering information from a variety of sources; organizing and storing information; performing measurements and collecting data in investigation or laboratory experiments; manipulating/analyzing/interpreting information or data to discover relationships, generate questions, and/or reach conclusions; communicating/reporting information, conclusions, or results of investigations, creating visual displays of data/information; communicating/

interacting with others in the classroom/school/outside of school; planning, refining, and producing audio/visual presentations; planning, drafting, proofreading, revising, publishing written text; creating graphics or visuals; generating original pieces of visual art and/or musical composition; publishing student projects or materials at remote locations on the Internet; performing calculations; and developing a more complete understanding of complex material or abstract concepts.

**TI015** Count of courses offered through both external (state or regional) and internal (district-wide) distance education.

***TI5. Are technology proficiencies and measures incorporated into teaching and learning standards?***

**TI016** General or subject-area (student) standards include items related to proficiency in the use of computer and networking technologies.

**TI017** The school or district has adopted standards for technology proficiency for students, but they are not integrated into general or subject-area standards for teaching and learning.

**TI018** Teacher standards include items related to proficiency in the use of computer and networking technology.

**TI019** The school or district has adopted standards for technology proficiency for teachers, but they are not integrated into general standards for teaching.

***TI6. Are technology proficiencies and measures incorporated into student assessment?***

**TI020** Student assessments include items directly or indirectly related to technology proficiency or use.

**TI021** Count of student assessments that are technology-based.

***TI7. Is technology incorporated into administrative processes?***

**TI022** Extent of student attendance computerization.

Note: See Chapter 7, especially section on Student Management System from the "Administrative Usage Rubric Objectives" table, for possible rubric for assessment of this category.

**TI023** Extent of staff attendance computerization.

Note: See Chapter 7, especially section on Human Resource Management from the "Administrative Usage Rubric Objectives" table, for possible rubric for assessment of this category.

**TI024** Computerization of staff/human resources management at the Local Education Agency (LEA) level

**Possible categories**: substitute management system that can be accessed anytime, record teacher absences, and provide substitute placement; position control integrated with General Ledger; payroll integrated with earnings history.

**TI025** Transportation management system.

**Possible categories**: data (students, staff, and financial) are synchronized and available on handheld devices. See also Chapter 7, especially section on Transportation Management from the "Administrative Usage Rubric Objectives" table, for possible rubric for assessment of this category.

**TI026** Food service management system.

Note: See Chapter 7, especially section on Food Service from the "Administrative Usage Rubric Objectives" table, for possible rubric for assessment of this category.

**TI027** Special education management system.

**Possible categories**: basic data; Individualized Educational Program (IEP); placements; evaluations; automated scheduling, tracking, and notification system.

**TI028** The LEA has a curriculum management application.

**TI029** The LEA has a library management system.

**TI030** Percentage of administrative applications with web-based access.

**TI031** Building-level access security control systems.

Note: See Chapter 7, especially section on Access from the "Administrative Usage Rubric Objectives" table, for possible rubric for assessment of this category.

**TI032** The LEA has a computerized fixed assets (capital assets) security and tracking management system, digital imaging system.

**TI033** An integrated management system exists that links two or more major administrative functions.

**TI034** Special education data are integrated with the LEA's student management system.

**TI035** Special education data are integrated with the LEA's transportation application.

**TI036** Building administrators and office staff have access to student data, financial data, and staff data.

**TI037** Building administrators and office staff utilize on-line budget development, purchase orders/requisitions, or action forms/board resolutions.

**TI038** Staff members have remote access to their payroll/benefits data, district policies, and/or attendance/sick time/vacation records.

**TI039** Student administrative application provides dynamic online data related to student attendance.

**TI040** Financial administrative application provides dynamic online data related to school budgets and/or purchasing.

**TI041** Facility and equipment access ID System exists for school or district.

**TI042** Extracurricular activities ID System exists for school or district.

**TI043** Total number of administrative applications hosted on-site.

**TI044** Total number of administrative applications hosted off-site.

**TI045** Total number of teachers using computer-based technologies on instruction-related administrative tasks.

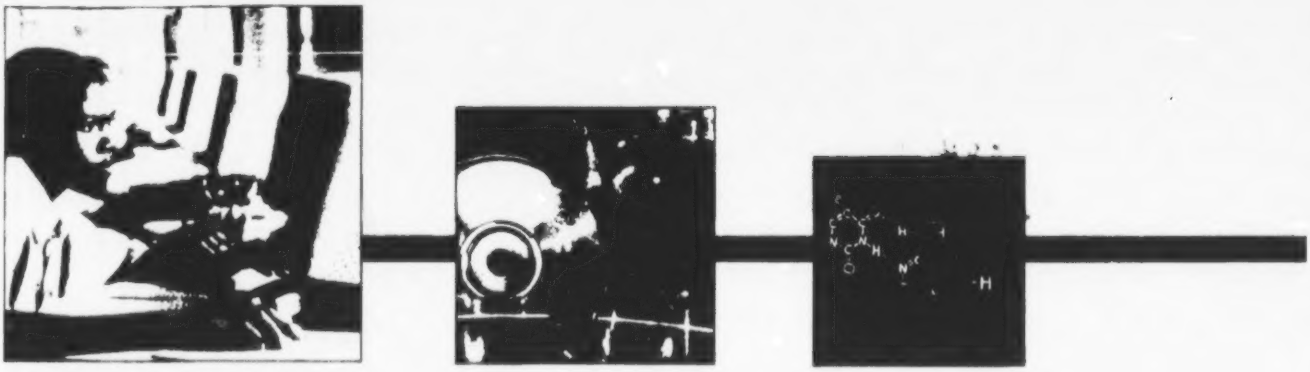
> **Example list of possible instruction-related administrative tasks**: computer-based attendance systems; computer-based grading systems; data warehousing or data mining for instructional decision support; computer-based IEP systems; online homework publication; online lesson plan publication; homework telephone hotline.

### *TI8. Is technology proficiency integrated into the evaluation of instructional and administrative staff?*

**TI046** Teachers in the school or district are required to demonstrate proficiency in technology applications, or to obtain a certification in the use of technology in education.

**TI047** Items related to technology proficiency, use, or to technology integration in instructional settings, are included in teacher evaluations.

**TI048** Assessment of technology proficiency or use is a component of administrator or support staff evaluation procedures.



# Appendix B

## Creating Indicators From Unit Records and Data Elements: Some Examples

Because the processes that lead from unit records to data elements and indicators are varied, detailing them for every data element listed in the guide would have been cumbersome and would have lengthened the volume into unintelligibility. Instead, we provide in what follows a small number of examples to illustrate these processes. We hope these will be helpful in guiding the readers as they think through issues of measurement, data collection, and interpretation of data collected.

### *Example 1*

Indicator: Percentage of teachers achieving acceptable performance on standards-based performance profiles of user skills.

[Chapter 7: Technology Integration. Key Question TI1. Are teachers proficient in the use of technology in the teaching/learning environment?]

Data elements: GC005, TI001.

GC005. Total number of teaching staff. Includes teachers with regular assignments as well as long-term substitutes; does not include short-term substitute teachers.

TI001. Number of teachers achieving acceptable performance on standards-based performance profiles of user skills.

Unit record: The choice of a unit record for this indicator will depend on the choice of a measure of teacher proficiency; see Chapter 7 for discussion of alternatives.

For purposes of this illustration, suppose the measurement for this indicator is based on the Fairfax County, Virginia, Public Schools approach. There are eight teacher technology competencies (see page 77, Chapter 7), and teachers are to be ratified or certified on each of them. In this case, a unit record might contain, for each teacher, a record for each competency; the record might have the following structure:

0 = teacher has not attempted to fulfill this competency;

1 = teacher has attempted, but not succeeded, to fulfill this competency; and

2 = teacher has successfully met the requirements for this competency.

Then a summary record might be created that specified that the teacher had met (or not) the technology competency. This record might be the sum of the eight individual technology competency scores, or some other approach might be taken; for example, if the sum were used, all teachers with a score of 16 would have passed all eight competencies, and any lower score would mean they had not passed all competencies.

Next, data element TI001 would be computed as the number of teachers with a score of 16 on the summary record described above.

Finally, the indicator for this key question would be the result of dividing TI001 by GC005, converted to a percentage.

### *Example 2*

Indicator: Average number of computers connected to the Internet per instructional setting.

[Chapter 3: Equipment and Infrastructure. Key Question EI1. Is equipment present in instructional settings?]

Data elements: GC001, EI013

GC001. Total number of instructional settings in the school building. Includes both regular classrooms and computer laboratories.

EI013. Total number of up-to-date computers connected to the Internet in instructional settings.

Unit record. The relevant unit records for computers are specified in Chapter 3. The date of purchase or installation and the description of the network connection are the records of interest for this indicator.

[Up-to-date computers are those purchased in the five years prior to data collection. It might also be necessary to specify that computers to be included should be currently in working order, with the regular approved suite of software and systems installed, and with a currently-operating network connection.]

The indicator for this key question would be the result of dividing EI013 by GC001.

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